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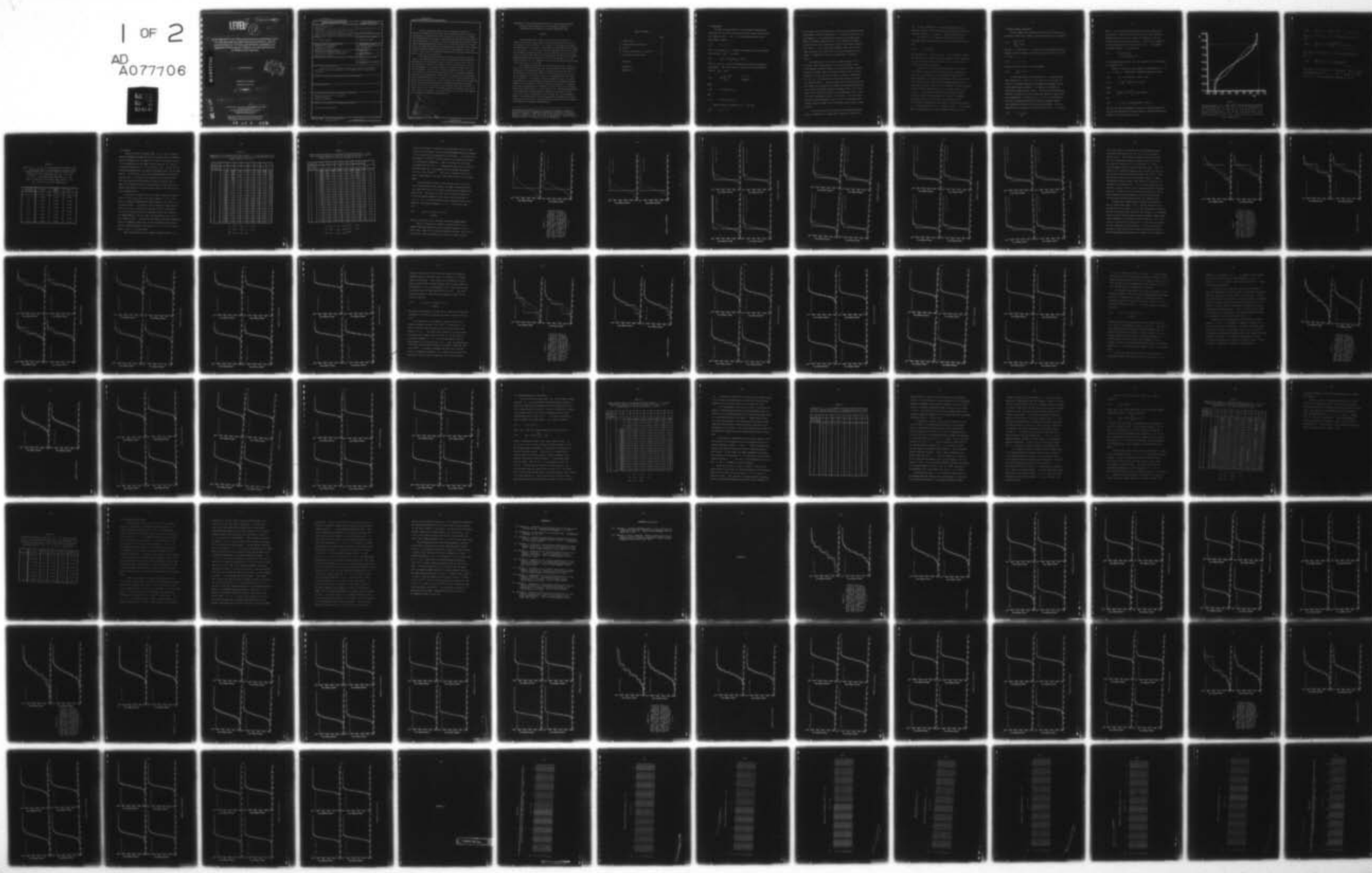

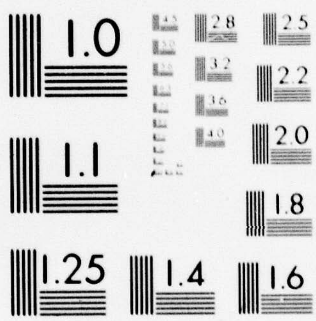

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CONVERGENCE OF THE CONDITIONAL DISTRIBUTION OF THE MAXIMUM LIKELIHOOD ESTIMATE, GIVEN LATENT TRAIT, TO THE ASYMPTOTIC NORMALITY: OBSERVATIONS MADE THROUGH THE CONSTANT INFORMATION MODEL

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The Constant Information Model can be used when we substitute a subset of equivalent, binary items, whose item characteristic functions are unknown, for the "Old Test," or a subset of test items whose operating characteristics are known, in estimating the operating characteristics of item response. In so doing, it has been suggested that we choose items whose common discrimination power is low, so that the interval of latent trait, for which their common item characteristic function in the Constant Information Model assumes positive values, is wide enough to cover the ability levels of all the examinees, on which the operating characteristics of new items are to be estimated.

This suggestion needs more investigation and precision, however, since it is expected from theory that the convergence of the conditional distribution of the maximum likelihood estimate, given latent trait, to the normality is slow for the values of latent trait which are close to the two endpoints of the above interval, in comparison with those close to the midpoint. In this paper, through a simulation study, the speed of convergence of the conditional distribution of the maximum likelihood estimate to the normality at various levels of latent trait is observed, using twenty 60 hypothetical test sessions, in each of which ten 80 equivalent, binary test items are given. As was expected, the conditional distribution of the maximum likelihood estimate is skewed for the values of latent trait close to the two endpoints of the interval, and the convergence is slower. From these results, the above suggestion is added by more precision, which is essential to the researchers who wish to apply this method in estimating the operating characteristics.

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ABSTRACT

Constant Information Model can be used when we substitute a subset of equivalent, binary items, whose item characteristic functions are unknown, for the "Old Test," or a subset of test items whose operating characteristics are known, in estimating the operating characteristics of item response. In so doing, it has been suggested that we choose items whose common discrimination power is low, so that the interval of latent trait, for which their common item characteristic function in the Constant Information Model assumes positive values, is wide enough to cover the ability levels of all the examinees, on which the operating characteristics of new items are to be estimated.

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The research was conducted at the principal investigator's laboratory, 409 Austin Peay Hall, Department of Psychology, University of Tennessee, Knoxville, Tennessee. Those who worked in the laboratory and helped the author in various ways for this research include Paul S. Changas, Robert L. Trestman, Philip S. Livingston, and Lin Wen Kuei-Chiu.

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I Introduction

Constant Information Model on the dichotomous response level (Samejima, 1972) of latent trait theory has been proposed and discussed (cf. Samejima, 1979). Let θ be a unidimensional latent trait, whose range is given by

(1.1) $$-\infty < \theta < \infty \quad ,$$

and g be a binary item. The model is defined by the item characteristic function, $P_g(\theta)$, such that

(1.2) $$P_g(\theta) = \sin^2[a_g(\theta - b_g) + (\pi/4)] \quad ,$$

where a_g and b_g are the discrimination and difficulty parameters, respectively. The model provides us with such an item information function, $I_g(\theta)$, that

(1.3) $$I_g(\theta) \begin{cases} = 4a_g^2 & \underline{\theta} < \theta < \bar{\theta} \\ = 0 & \text{otherwise} \end{cases} \quad ,$$

where

(1.4) $$\underline{\theta} = [-\pi a_g^{-1}/4] + b_g$$

and

(1.5) $$\bar{\theta} = [\pi a_g^{-1}/4] + b_g \quad .$$

When we consider a subinterval of θ such that

(1.6) $$\underline{\theta} < \theta < \bar{\theta}$$

as its range, the item characteristic function of the Constant Information Model is strictly increasing in θ , with zero and unity as its two asymptotes --- the characteristics shared by the normal ogive model, the logistic model, and so on. For convenience, hereafter, we shall call the set of models which share this particular characteristic Type A . It has been shown (Samejima, 1979) that the area under the curve of the square root of the item information function equals π regardless of the model, provided that it belongs to Type A .

One usefulness of the Constant Information Model is that, by virtue of the transformation-free character (Samejima, 1969) of the maximum likelihood estimate, we can adopt this model whenever we locate a suitable subset of equivalent, binary items in a newly developed item pool, and use this subset of items as a substitute for the set of items whose operating characteristics are known (cf. Samejima, 1979). Thus we can make use of various combinations of a method and an approach for estimating the operating characteristics of the item response categories (Samejima, 1977a, 1977b, 1978a, 1978b, 1978c, 1978d, 1978e, 1978f) without depending upon the subset of a priori investigated items, or the Old Test. The only assumption used in this procedure is that the "true" item characteristic function, which is common to these equivalent, binary items, belongs to Type A.

In the actual process of estimating the operating characteristics, a combination of a method and an approach is selected for

use. In these combinations of a method and an approach, the asymptotic normality of the conditional distribution of the maximum likelihood estimate, $\hat{\theta}$, given θ , plays an important role.

For the test of n equivalent, binary items, Constant Information Model provides us with such a test information function that

$$(1.7) \qquad I(\theta) = 4na_g^2 ,$$

for the interval of θ given by (1.6). In the asymptotic normal distribution of the maximum likelihood estimate, the two parameters, i.e., the conditional mean and variance, are θ and the inverse of the test information function.

Estimation of the operating characteristics of the graded item response categories will be pursued further, by making more use of the characteristics of the polynomials obtained by the method of moments (cf. Samejima and Livingston, 1979), and so forth. In so doing, the role of the Constant Information Model will be important, as long as we wish to use the methods for a newly developed item pool, without depending upon a set of "known" items, or the Old Test. One problem we should seriously investigate before using the Constant Information Model for a subset of "unknown," equivalent items of the item pool concerns the differences in the speed of convergence to the normality caused by the positions of θ in the interval, $(\underline{\theta}, \bar{\theta})$ (cf. Samejima, 1979). In the present paper, we shall pursue this subject through a Monte Carlo study.

II Method and Data Calibration

For the common item characteristic function of the hypothetical equivalent, binary items, Constant Information Model with the parameters,

$$(2.1) \quad \begin{cases} a_g = 0.25 \\ b_g = 0.00 \end{cases} ,$$

was used. The interval of θ for which the item information function assumes a positive constant is, therefore, given from (1.4), (1.5) and (1.6) by

$$(2.2) \quad -\pi < \theta < \pi ,$$

and we have for the amount of item information

$$(2.3) \quad I_g(\theta) = 0.25 .$$

As the fixed levels of the latent trait θ, eight positions were selected, i.e., -3.0, -2.2, -1.4, -0.6, 0.2, 1.0, 1.8 and 2.6 . A group of one hundred hypothetical examinees were assigned to each of the eight levels of ability θ, to make the total number of hypothetical examinees eight hundred. There were twenty hypothetical sessions of testing, and in each session ten equivalent, binary items were administered. An item score u_g (= 0 or 1) was calibrated by the Monte Carlo method following the Constant Information Model, whose parameters were given in the preceding paragraph. After the completion of each session, the (cumulative) test score t such that

$$(2.4) \quad t = \sum_{u_g \in V} u_g ,$$

where V is the response pattern obtained after the completion of each session, or the vector of item scores to the items, which were administered by the end of the session, was computed for each of the eight hundred hypothetical examinees. Thus after the completion of the k-th session the full test score is $10 \times k$. The maximum likelihood estimate $\hat{\theta}$ was obtained by

$$(2.5) \qquad \begin{aligned} \hat{\theta} &= P_g^{-1}[t/(10k)] \\ &= 4 \sin^{-1}\{[t/(10k)]^{1/2}\} - \pi \end{aligned}$$

for each hypothetical subject, after the completion of the k-th session (cf. Samejima, 1979).

Figure 2-1 illustrates three different transformations of θ to τ_1 , τ_2 and τ_3 , respectively, through the formulae such that

$$(2.6) \qquad \tau_1 = 5.00 \sin^2[0.25\theta + (\pi/4)] - 2.50 \quad ,$$

$$(2.7) \qquad \tau_2 = P_g^{**-1} [\sin^2\{0.25\theta + (\pi/4)\}] \quad ,$$

where

$$(2.8) \qquad P_g^{**}(\theta) = (2\pi)^{-1/2} \int_{-\infty}^{s} \exp[-u^2/2]\, du \quad ,$$

and

$$(2.9) \qquad \tau_3 = (2/1.7) \log [\tan\{(0.25\theta) + (\pi/4)\}] \ .$$

They are the three transformations, which are eventually required if the true item characteristic function common to these equivalent items follows: 1) the linear model such that

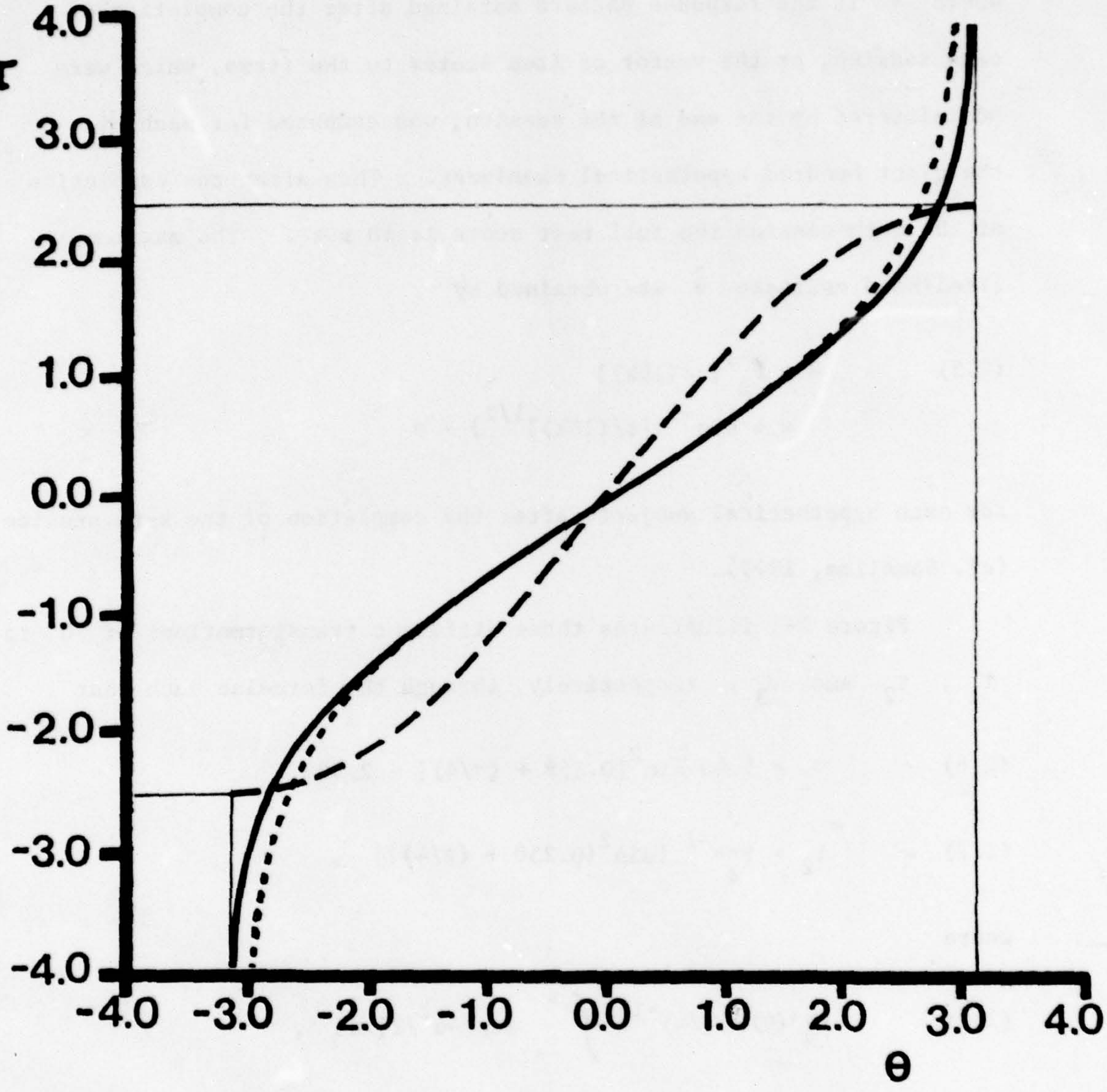


FIGURE 2-1

Transformations of θ to τ Which Result from Transforming the Constant Information Model with $a_g = 0.25$ and $b_g = 0.00$ As the Parameters, to the Linear Model with $\alpha_g = -2.50$ and $\beta_g = 2.50$ (Broken Curve), to the Normal Ogive Model with $a_g = 1.00$ and $b_g = 0.00$ (Solid Curve), and to the Logistic Model with $D = 1.70$, $a_g = 1.00$ and $b_g = 0.00$ (Dotted Curve), Respectively.

$$P^{*}_{g}(\tau_1) = (\tau_1 - \alpha_g)(\beta_g - \alpha_g)^{-1} \qquad \text{for} \quad \alpha_g < \tau_1 < \beta_g \ , \tag{2.10}$$

with $\alpha_g = -2.50$ and $\beta_g = 2.50$, 2) the normal ogive model such that

$$P^{**}_{g}(\tau_2) = (2\pi)^{-1/2} \int_{-\infty}^{a^{*}_{g}(\tau_2 - b^{*}_{g})} \exp[-u^2/2]\, du \qquad \text{for} \quad -\infty < \tau_2 < \infty \ , \tag{2.11}$$

with $a^{*}_{g} = 1.00$ and $b^{*}_{g} = 0.00$, and 3) the logistic model such that

$$P^{***}_{g}(\tau_3) = [1 + \exp\{-1.7a^{**}_{g}(\tau_3 - b^{**}_{g})\}]^{-1} \qquad \text{for} \quad -\infty < \tau_3 < \infty \ , \tag{2.12}$$

with $a^{**}_{g} = 1.00$ and $b^{**}_{g} = 0.00$, respectively. Table 2-1 presents the corresponding values of τ_1 , τ_2 and τ_3 to each of the eight levels of θ , at which hypothetical examinees are located.

TABLE 2-1

Values of τ_1 , τ_2 and τ_3 Corresponding to the Eight Levels of θ , Which Result from the Transformations from the Constant Information Model with $a_g = 0.25$ and $b_g = 0.00$ As the Parameters, to the Linear Model with $\alpha_g = -2.50$ and $\beta_g = 2.50$, to the Normal Ogive Model with $a_g = 1.00$ and $b_g = 0.00$ and to the Logistic Model with $D = 1.70$, $a_g = 1.00$ and $b_g = 0.00$, Respectively.

Constant Information	Linear	Normal Ogive	Logistic
θ	τ_1	τ_2	τ_3
-3.0	-2.494	-3.023	-3.930
-2.2	-2.228	-1.604	-1.680
-1.4	-1.611	-0.923	-0.900
-0.6	-0.739	-0.379	-0.358
0.2	0.250	0.125	0.118
1.0	1.199	0.642	0.614
1.8	1.958	1.235	1.240
2.6	2.409	2.092	2.345

III Results

Table 3-1 presents the sample mean, $m_{\hat{\theta}}$, of the one hundred maximum likelihood estimates for each of the eight groups of examinees, which was obtained after the completion of each of the twenty sessions. It is observed that, as the number of items increases, $m_{\hat{\theta}}$ tends to approach the true ability θ on each ability level. And yet we find substantial differences in the speed of convergence across the different groups. In this table, all the entries whose absolute discrepancies from the true θ are greater than or equal to 0.15 are marked with ***, those the absolute discrepancies of which are greater than or equal to 0.10 and less than 0.15 are marked with **, and those whose absolute discrepancies are greater than or equal to 0.05 and less than 0.05 are marked with * .

We can see from Table 3-1 that, for Group 1, whose true ability level (= -3.0) is very close to the lower endpoint $\underline{\theta}$ (= $-\pi$), even after 200 items were administered, the discrepancy of $m_{\hat{\theta}}$ from θ is as large as 0.061 . In contrast to this, for Group 5, whose ability level is 0.2, i.e., closest of all the eight levels to the midpoint (= 0.0) of the interval, after the completion of the first session, or the administration of only ten items, the discrepancy of $m_{\hat{\theta}}$ from θ is as small as 0.020 . For the other six groups, with some fluctuations, there is a luminous tendency that, as the true ability level departs from the closer end point of the interval, $\underline{\theta}$ or $\bar{\theta}$ (=π), the convergence of $m_{\hat{\theta}}$ to θ becomes faster.

Table 3-2 provides us with the sample standard deviation, $s_{\hat{\theta}}$,

TABLE 3-1

Sample Mean of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8
Session \ θ	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	-3.142**	-2.587***	-1.453*	-0.677*	0.219	1.121**	2.068***	2.815***
2	-3.142**	-2.440***	-1.428	-0.637	0.214	1.082*	1.855*	2.816***
3	-3.142**	-2.342**	-1.451*	-0.625	0.195	1.045	1.811	2.759***
4	-3.142**	-2.302**	-1.445	-0.596	0.200	1.042	1.811	2.731**
5	-3.136**	-2.264*	-1.440	-0.566	0.203	1.046	1.810	2.732**
6	-3.116**	-2.264*	-1.414	-0.559	0.220	1.037	1.789	2.706**
7	-3.113**	-2.241	-1.412	-0.571	0.205	1.024	1.795	2.702**
8	-3.115**	-2.233	-1.416	-0.563	0.202	1.025	1.794	2.696*
9	-3.117**	-2.227	-1.416	-0.577	0.201	1.025	1.806	2.686*
10	-3.114**	-2.232	-1.415	-0.580	0.197	1.024	1.796	2.670*
11	-3.108**	-2.220	-1.411	-0.583	0.196	1.017	1.801	2.674*
12	-3.105**	-2.211	-1.419	-0.587	0.186	1.019	1.799	2.668*
13	-3.102**	-2.218	-1.419	-0.598	0.188	1.018	1.803	2.660*
14	-3.097*	-2.212	-1.422	-0.594	0.190	1.017	1.803	2.649
15	-3.088*	-2.209	-1.419	-0.596	0.196	1.015	1.801	2.635
16	-3.077*	-2.198	-1.414	-0.598	0.198	1.013	1.802	2.639
17	-3.075*	-2.197	-1.407	-0.599	0.199	1.016	1.801	2.629
18	-3.073*	-2.191	-1.404	-0.608	0.202	1.017	1.804	2.615
19	-3.068*	-2.192	-1.400	-0.612	0.206	1.020	1.804	2.613
20	-3.061*	-2.194	-1.401	-0.611	0.206	1.020	1.800	2.615

* $0.05 \leq |m_{\hat{\theta}} - \theta| < 0.10$

** $0.10 \leq |m_{\hat{\theta}} - \theta| < 0.15$

*** $0.15 \leq |m_{\hat{\theta}} - \theta|$

TABLE 3-2

Sample Standard Deviation of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8	$[I(\theta)]^{-1/2}$
Session \ θ	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6	
1	0.000***	0.735**	0.810***	0.812***	0.686*	0.844***	0.908***	0.570*	0.632
2	0.000***	0.556**	0.490	0.464	0.460	0.517*	0.592**	0.461	0.447
3	0.000***	0.465**	0.415*	0.359	0.403	0.368	0.482**	0.410	0.365
4	0.000***	0.407*	0.330	0.319	0.328	0.297	0.383*	0.374*	0.316
5	0.057***	0.297	0.285	0.273	0.280	0.274	0.321	0.347*	0.283
6	0.113**	0.270	0.261	0.267	0.252	0.235	0.267	0.310*	0.258
7	0.114**	0.226	0.232	0.251	0.229	0.216	0.248	0.286	0.239
8	0.107**	0.212	0.225	0.235	0.219	0.211	0.222	0.276*	0.224
9	0.100**	0.214	0.222	0.217	0.203	0.197	0.216	0.262*	0.211
10	0.102*	0.214	0.216	0.205	0.198	0.196	0.203	0.239	0.200
11	0.109*	0.200	0.202	0.213	0.187	0.187	0.184	0.233	0.191
12	0.110*	0.186	0.191	0.198	0.174	0.178	0.175	0.223	0.183
13	0.115*	0.180	0.178	0.188	0.162	0.166	0.173	0.210	0.175
14	0.118*	0.171	0.167	0.173	0.163	0.162	0.169	0.208	0.169
15	0.124	0.165	0.166	0.172	0.154	0.157	0.170	0.189	0.163
16	0.130	0.163	0.163	0.164	0.146	0.157	0.163	0.187	0.158
17	0.131	0.159	0.160	0.157	0.140	0.150	0.158	0.169	0.153
18	0.132	0.152	0.157	0.153	0.137	0.146	0.154	0.143	0.149
19	0.135	0.149	0.157	0.153	0.135	0.142	0.156	0.138	0.145
20	0.135	0.141	0.153	0.155	0.130	0.137	0.150	0.121	0.141

$$* \quad 0.05 \leq \left| s_{\hat{\theta}} - \{I(\theta)\}^{-1/2} \right| < 0.10$$

$$** \quad 0.10 \leq \left| s_{\hat{\theta}} - \{I(\theta)\}^{-1/2} \right| < 0.15$$

$$*** \quad 0.15 \leq \left| s_{\hat{\theta}} - \{I(\theta)\}^{-1/2} \right|$$

which was calculated by using 10k as the denominator after the completion of the k-th session, of the one hundred maximum likelihood estimates for each group after the completion of each session. In the same table, the values of $[I(\theta)]^{-1/2}$ are also given in the rightest hand column, for the purpose of comparison. Some of the entries of this table are marked with ***, ** or * , following the same rule as we used for the sample mean $m_{\hat{\theta}}$, in accordance with the absolute discrepancy of the $s_{\hat{\theta}}$ from $[I(\theta)]^{-1/2}$. We observe a tendency in Table 3-2, which is very similar to the one we have found in Table 3-1, the sample means.

We notice that for Group 1, whose ability level is very close to the lower endpoint of the interval, the sample standard deviation $s_{\hat{\theta}}$ equals zero after 10, 20, 30 and 40 items have been administered, respectively. This owes to the fact that the response patterns of all the one hundred examinees of this group consist, uniformly, of $u_g = 0$, up to the fourth session, and the likelihood function has, therefore, the terminal maximum at $\theta = -\pi$. Since we have from (1.2)

$$P_g(-3.0) = \sin^2[(-3.0 + \pi)/4] \doteq 0.00125 , \tag{3.1}$$

which is very close to zero, the above results are understandable.

Figure 3-1 presents the cumulative frequency ratios of the maximum likelihood estimates of the one hundred examinees of Group 1 (solid line), along with the normal distribution function, $N(\theta, I(\theta)^{-1})$ (solid curve), after the completion of each of the twenty sessions.

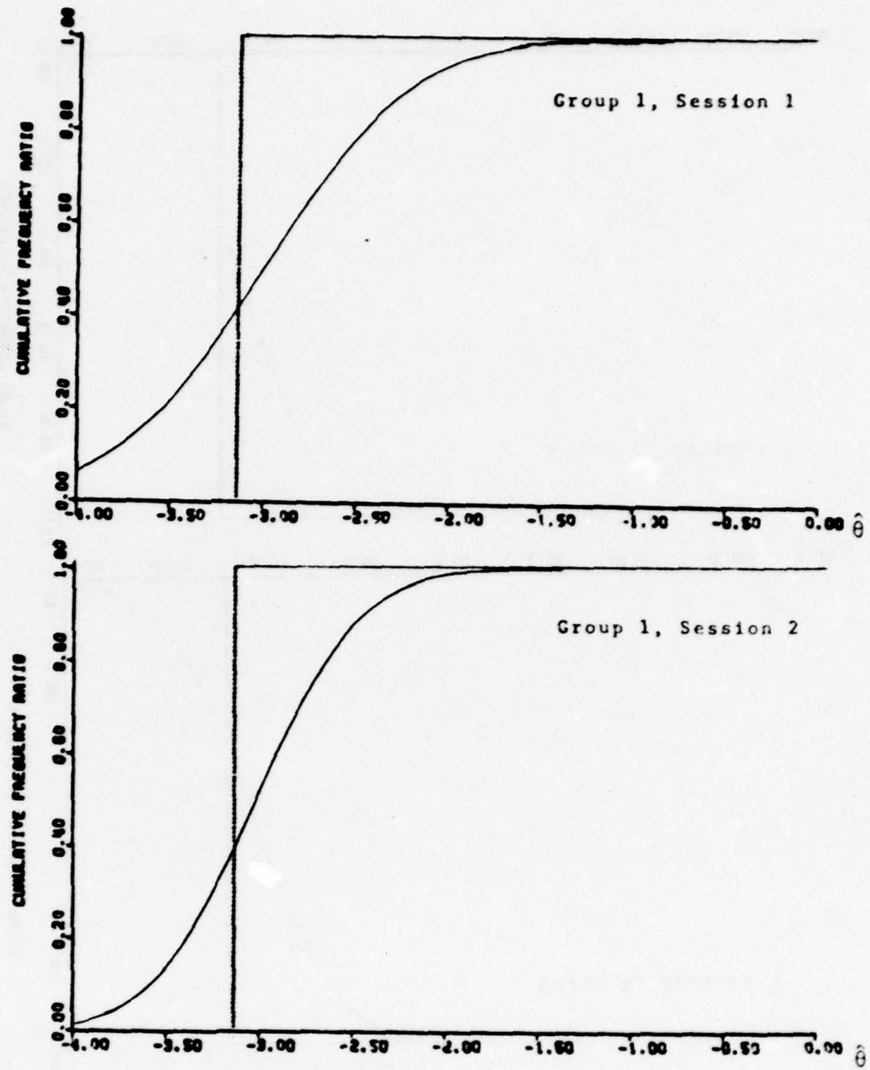


FIGURE 3-1

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -3.0$

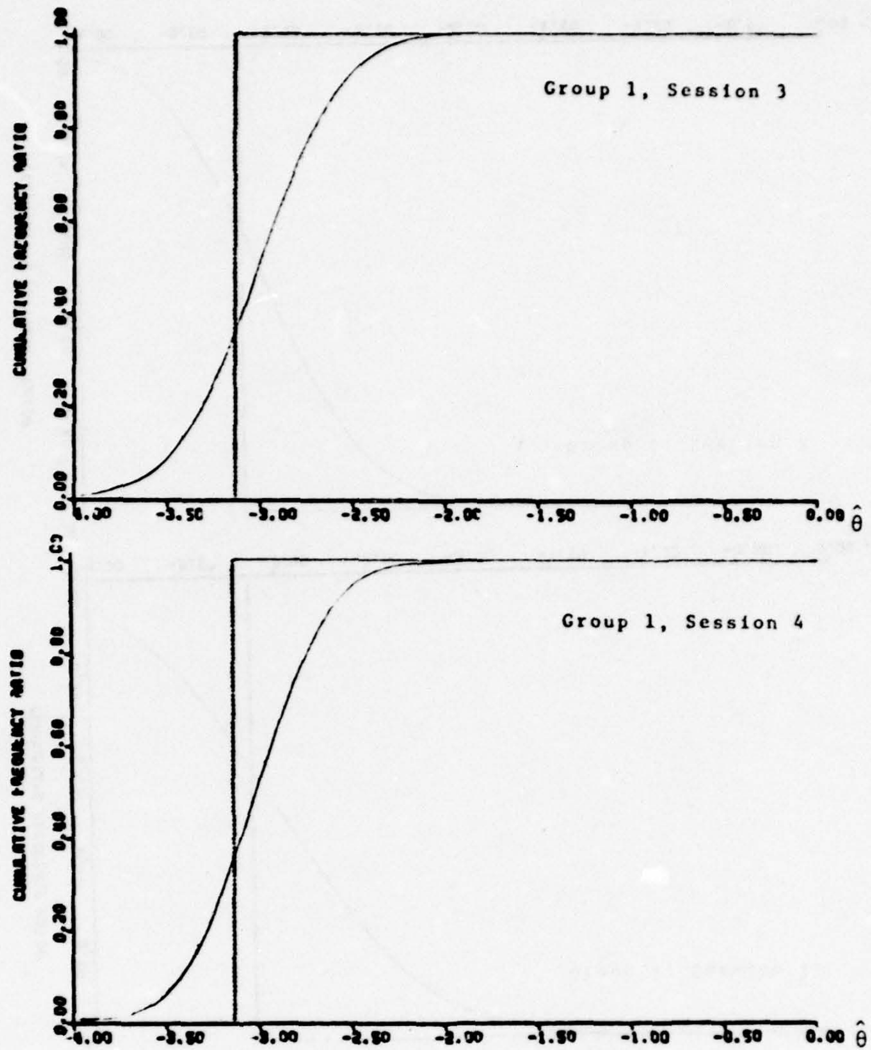
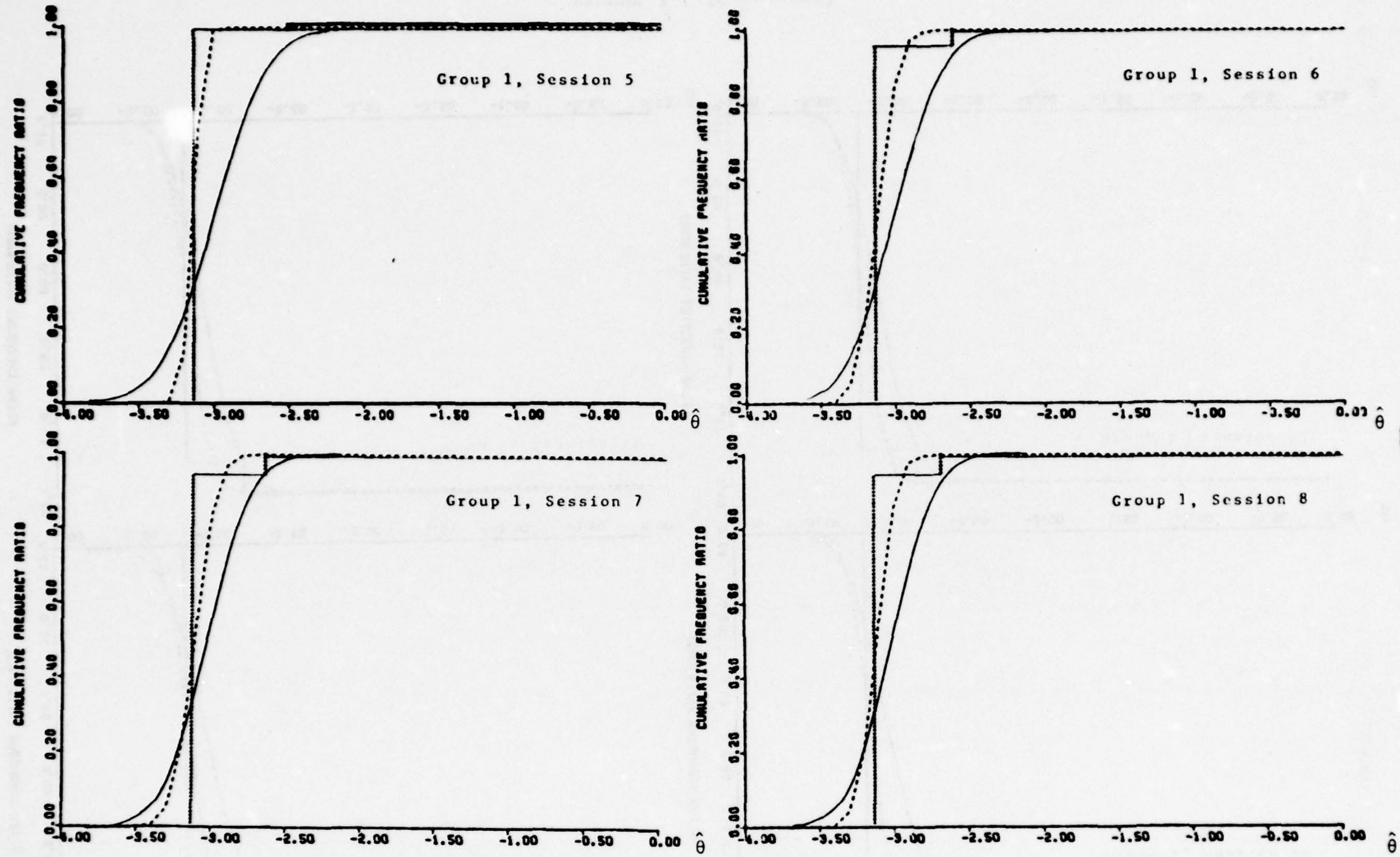


FIGURE 3-1 (Continued)



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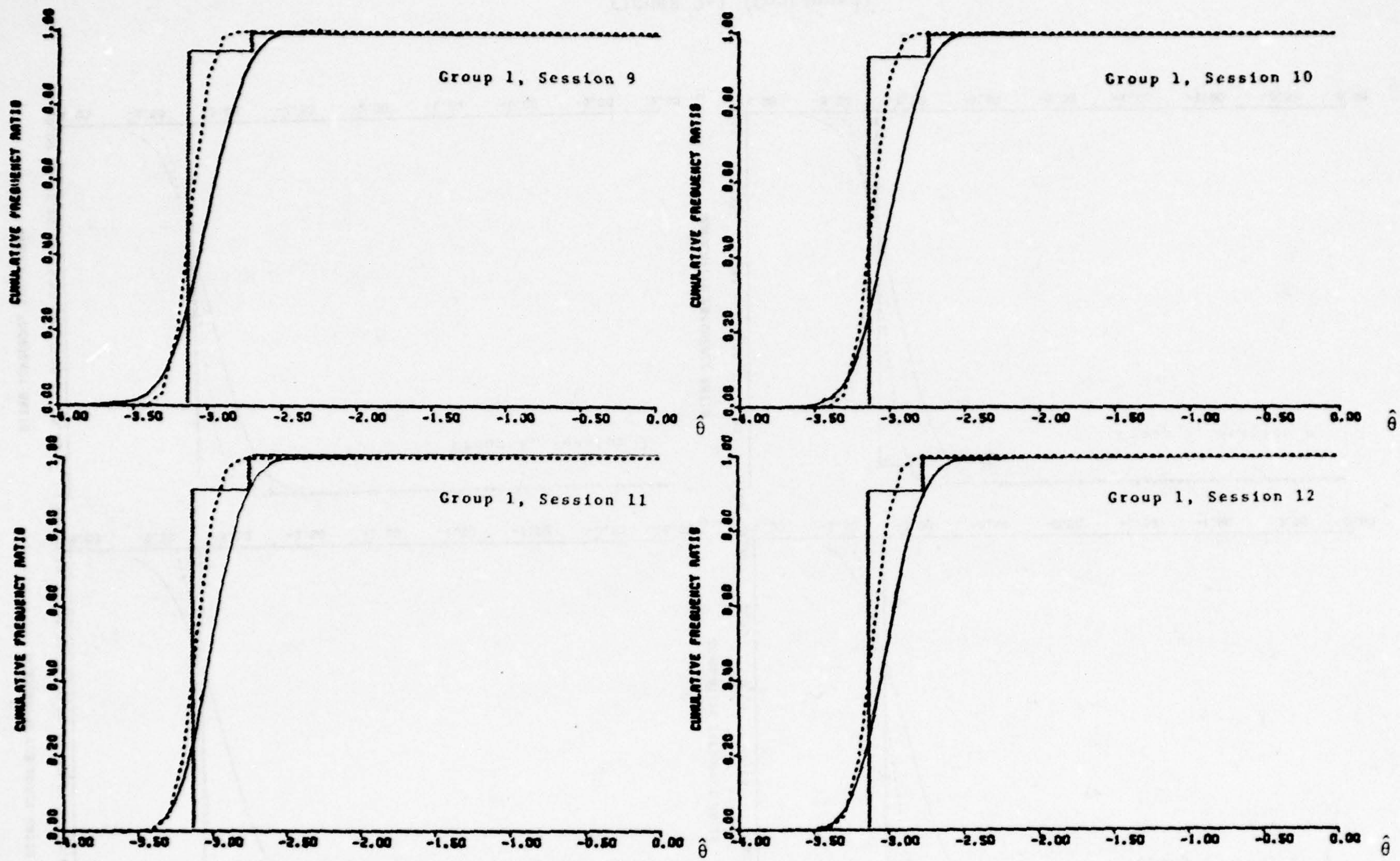

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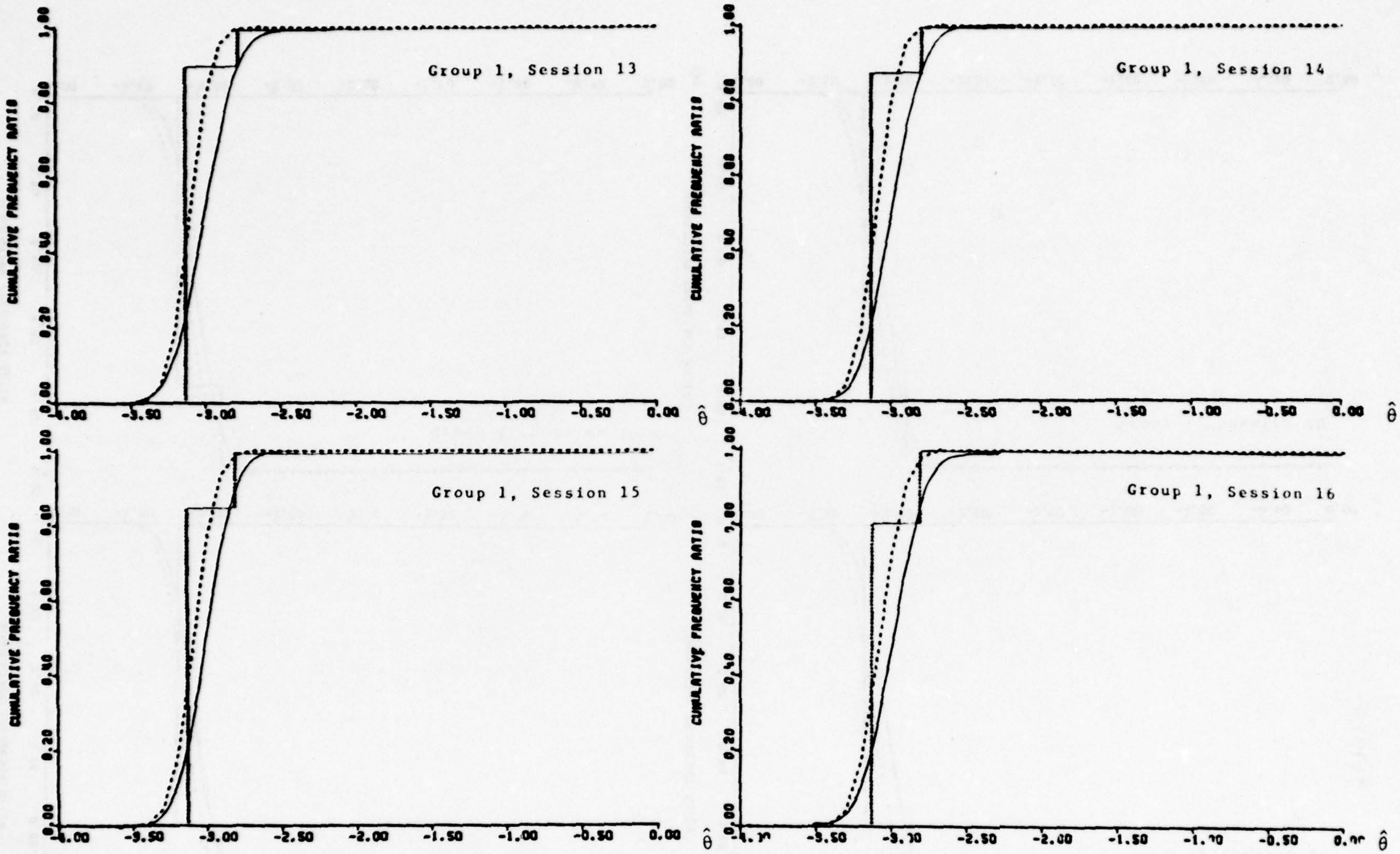

FIGURE 3-1 (Continued)

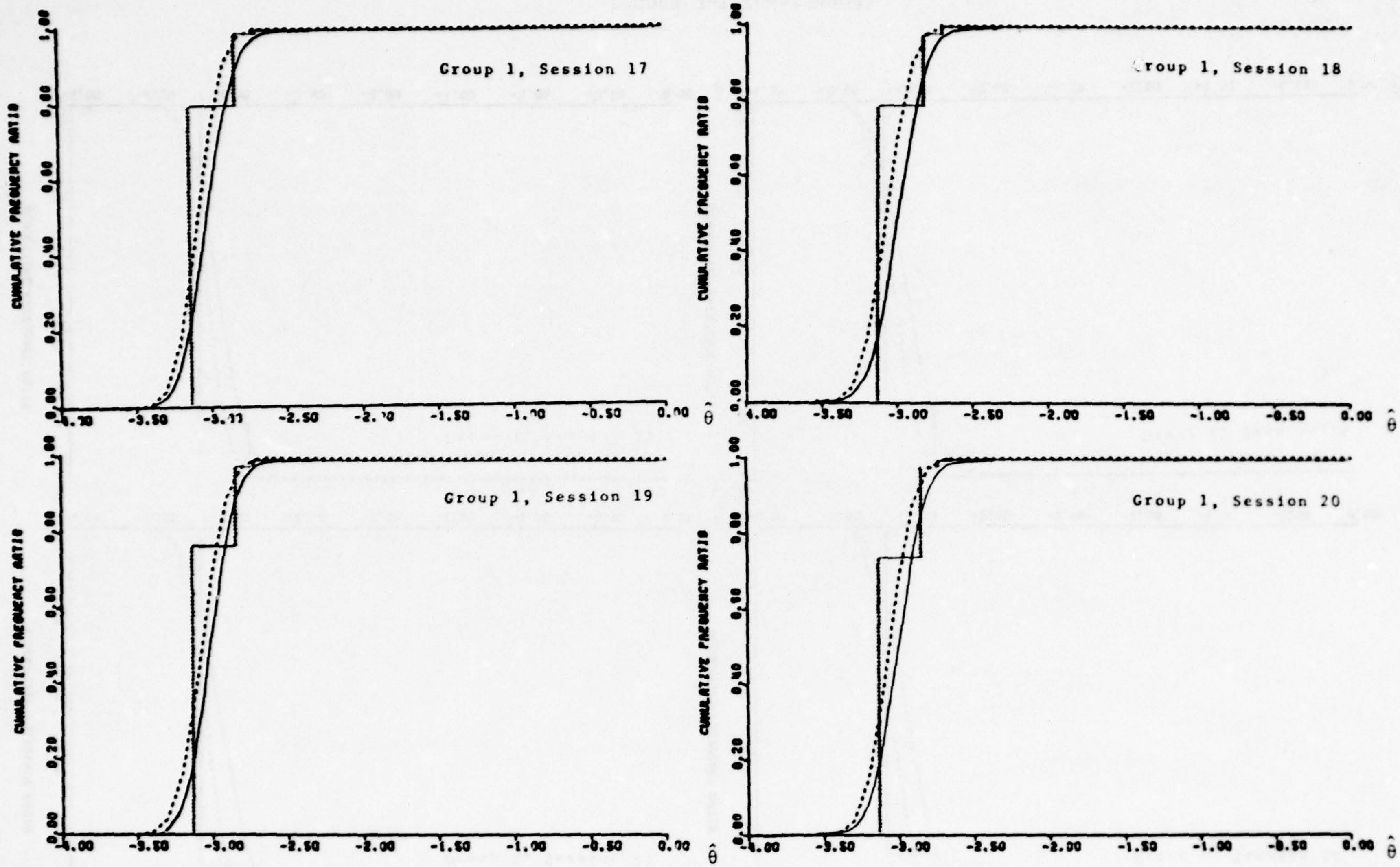

FIGURE 3-1 (Continued)

In the same figure, also presented are the corresponding normal distribution functions with $m_{\hat{\theta}}$ and $s^2_{\hat{\theta}}$ as the two parameters (dotted curves). These normal distribution functions coincide with the corresponding cumulative frequency ratios in the first four graphs of Figure 3-1, i.e., for sessions 1, 2, 3 and 4 , since the sample variance is zero in these four cases. The discrepancy of the cumulative frequency ratio, and that of $N(m_{\hat{\theta}}, s^2_{\hat{\theta}})$, from the other normal distribution function, $N(\theta, I(\theta)^{-1})$, are substantially large even in the last graph of Figure 3-1, where the maximum likelihood estimates were obtained on the basis of the responses to two hundred items. It is also worth noting that the cumulative frequency ratio of each of the twenty graphs of Figure 3-1 indicates a J-shape curve for the frequency distribution of the one hundred maximum likelihood estimates, the result which confirms our theoretical anticipation made earlier (cf. Samejima, 1979).

A similar set of twenty graphs as Figure 3-1 was made for Group 8, whose ability level (= 2.6) is the next closest to one of the endpoints of the interval, $(-\pi, \pi)$, and is presented as Figure 3-2. We find in this figure that, unlike the case of Group 1, the cumulative frequency ratio of the one hundred maximum likelihood estimates shows a good convergence to the normal distribution function, $N(\theta, I(\theta)^{-1})$, in each of the last three or four graphs, or after 170 or more items have been administered to the examinees. For this ability level, although a J-shape curve for the frequency distribution of the one hundred maximum likelihood estimates is indicated by the cumulative

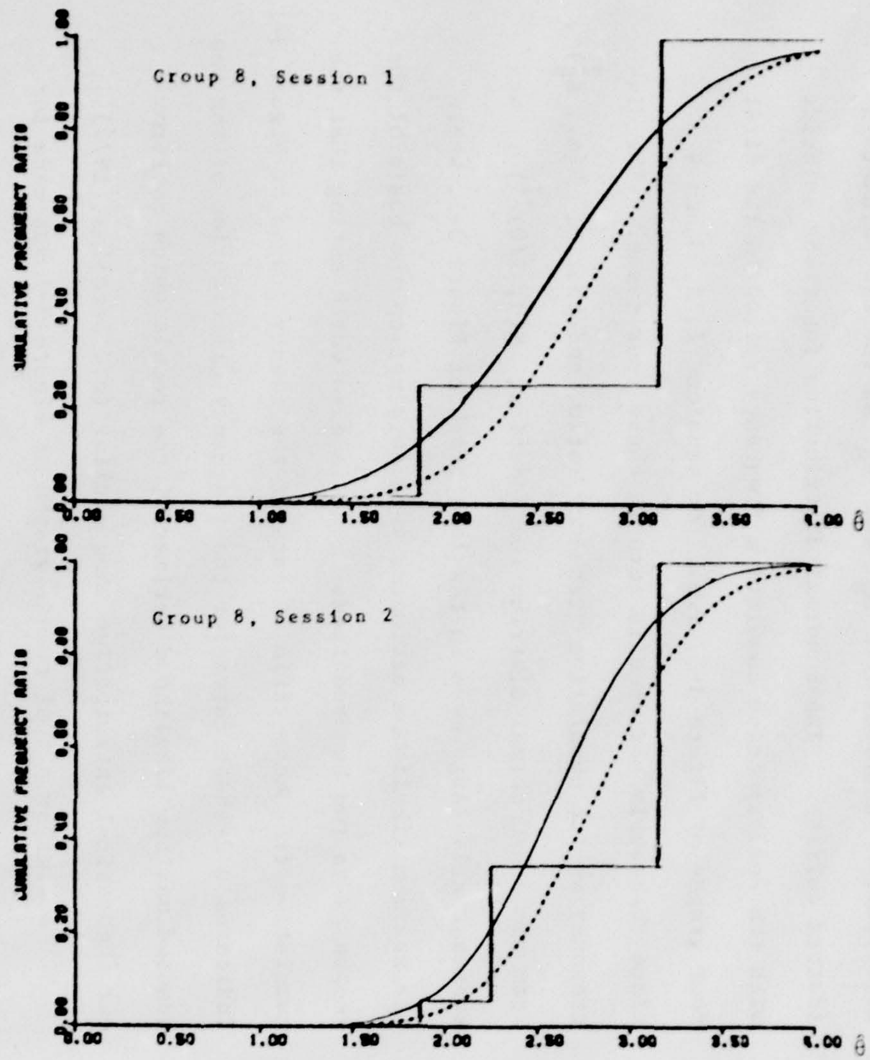

FIGURE 3-2

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 2.6$

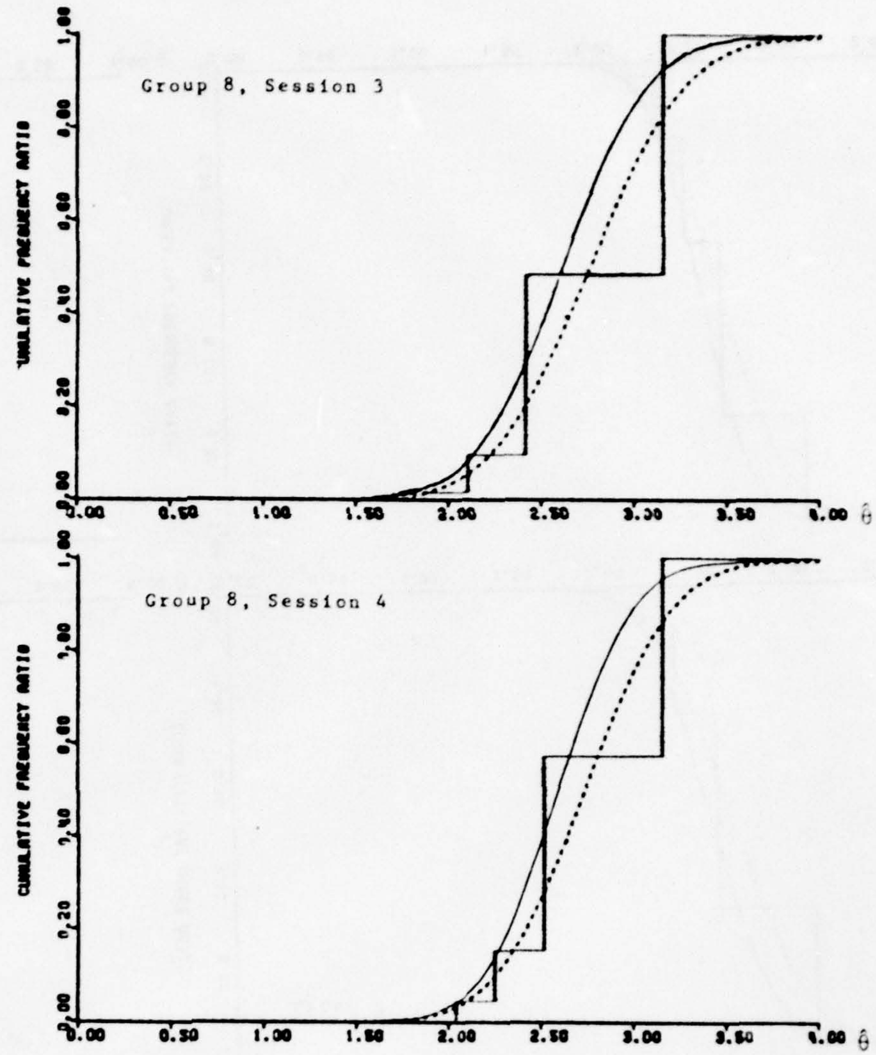

FIGURE 3-2 (Continued)

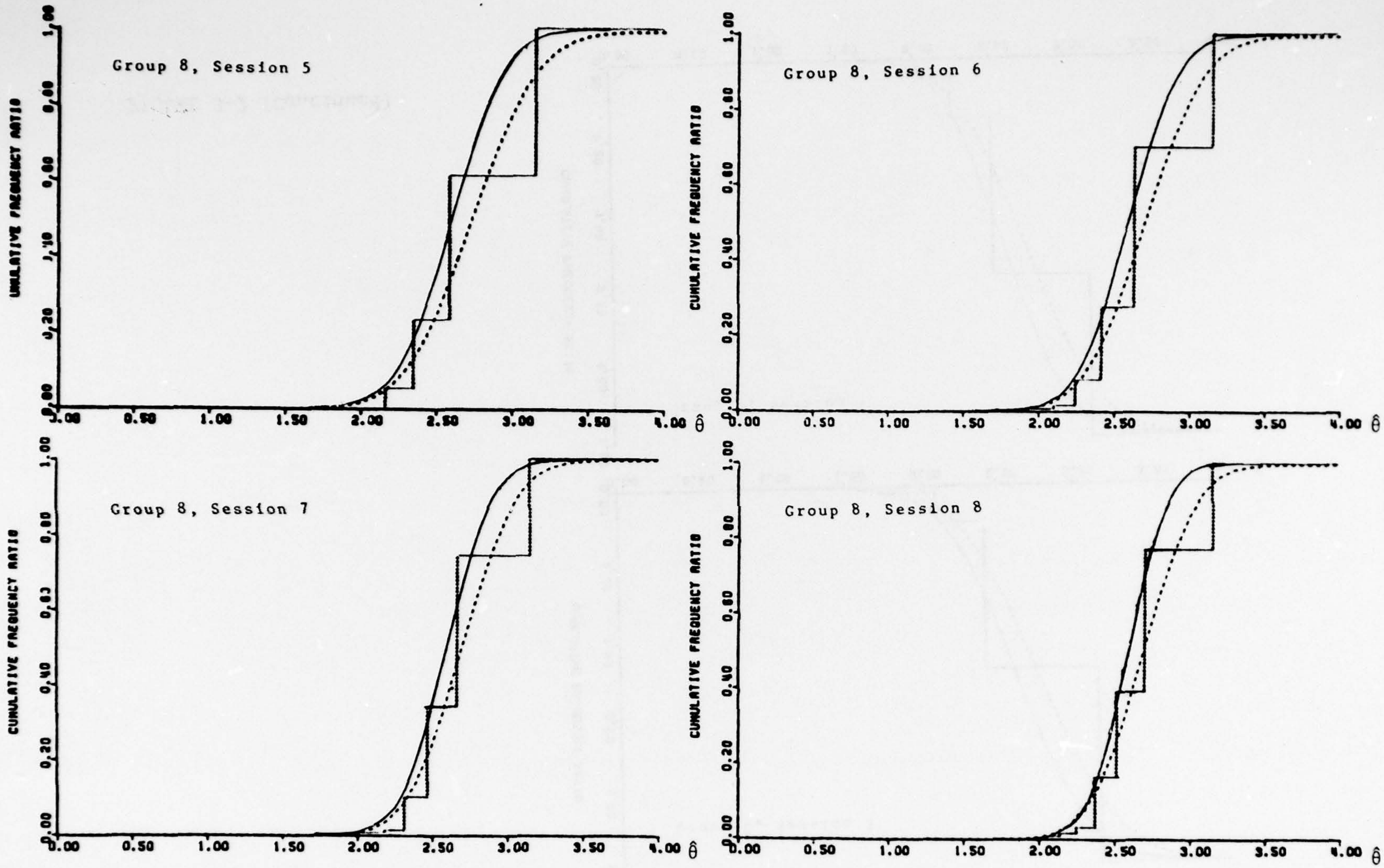

FIGURE 3-2 (Continued)

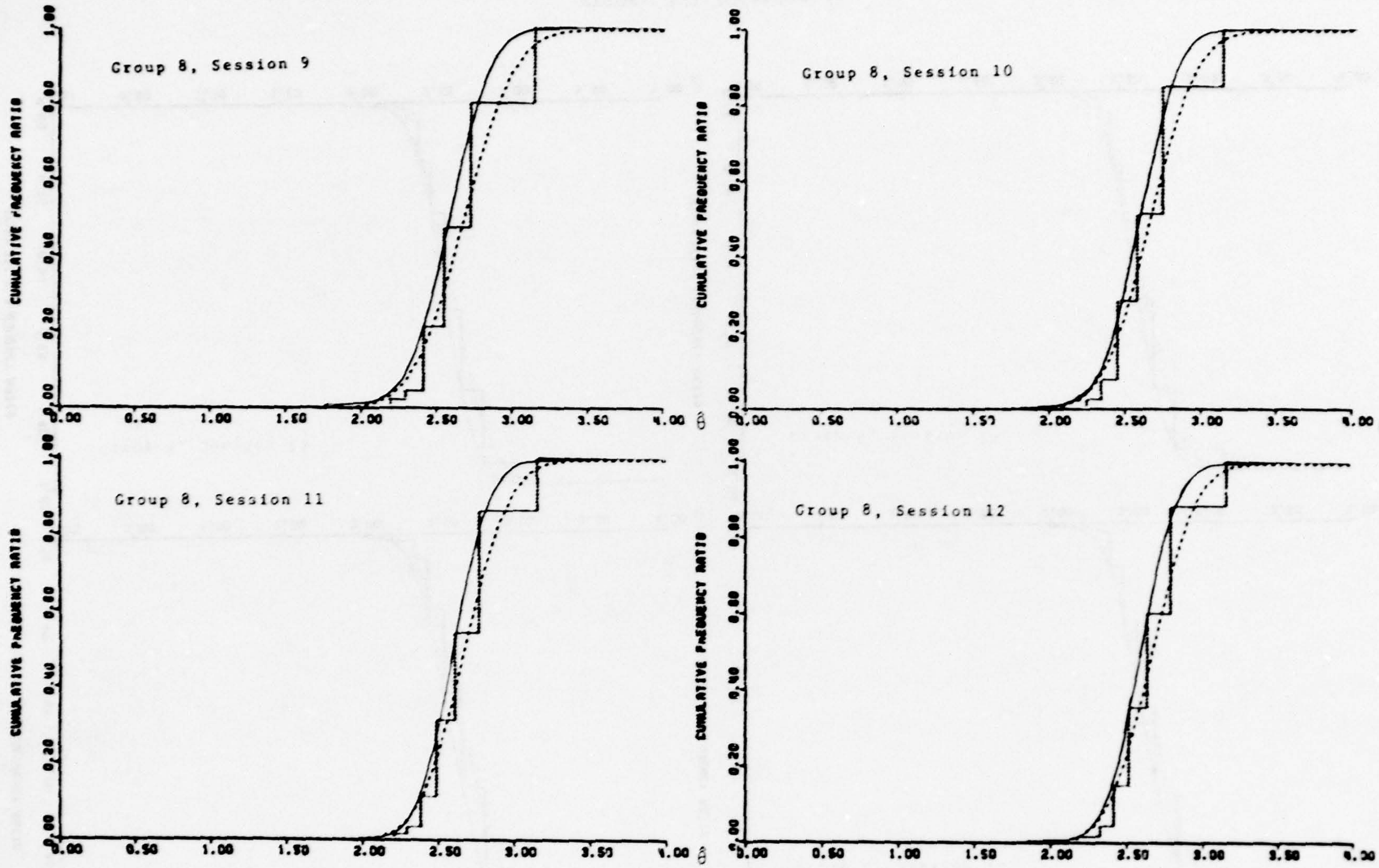

FIGURE 3-2 (Continued)

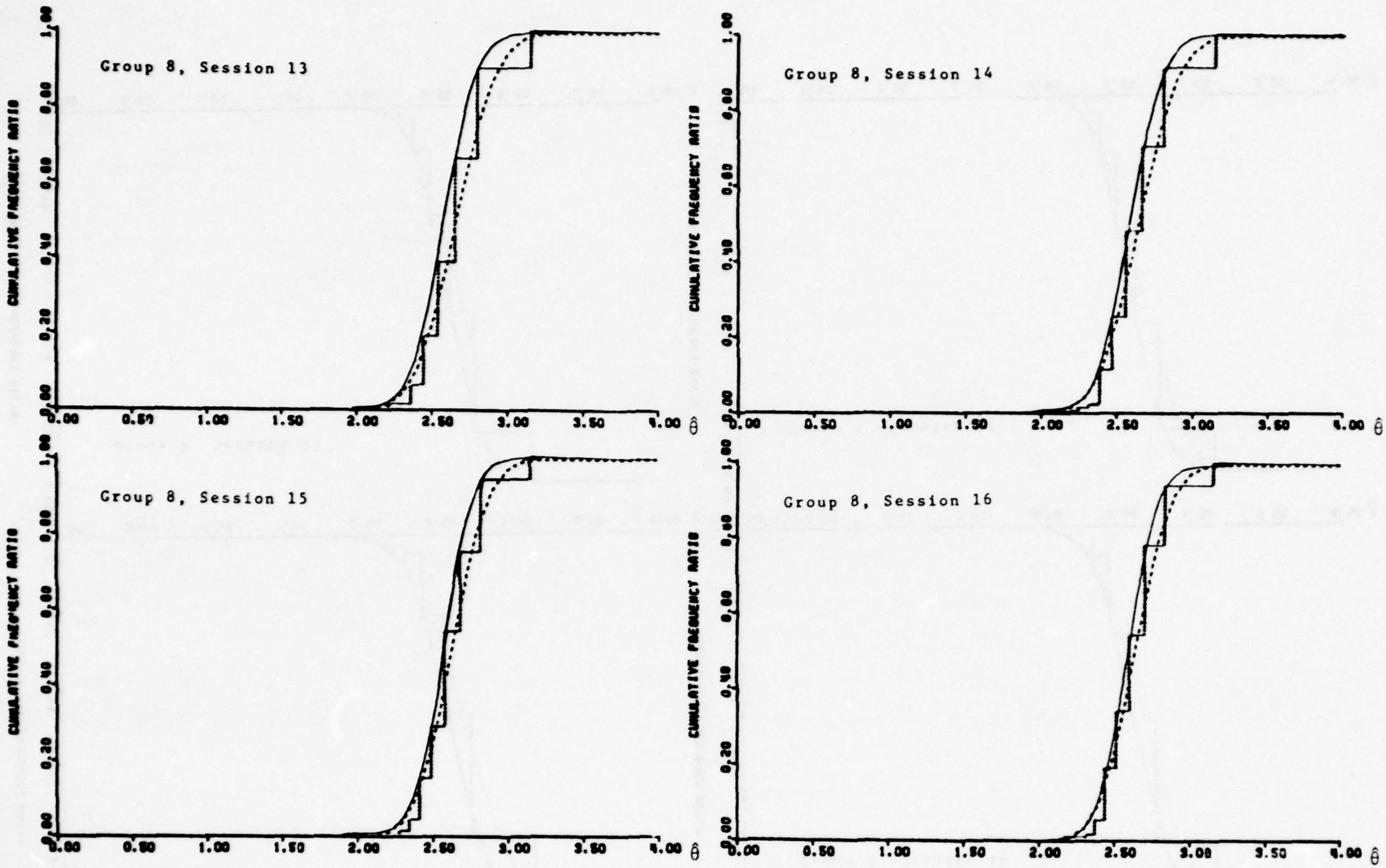

FIGURE 3-2 (Continued)

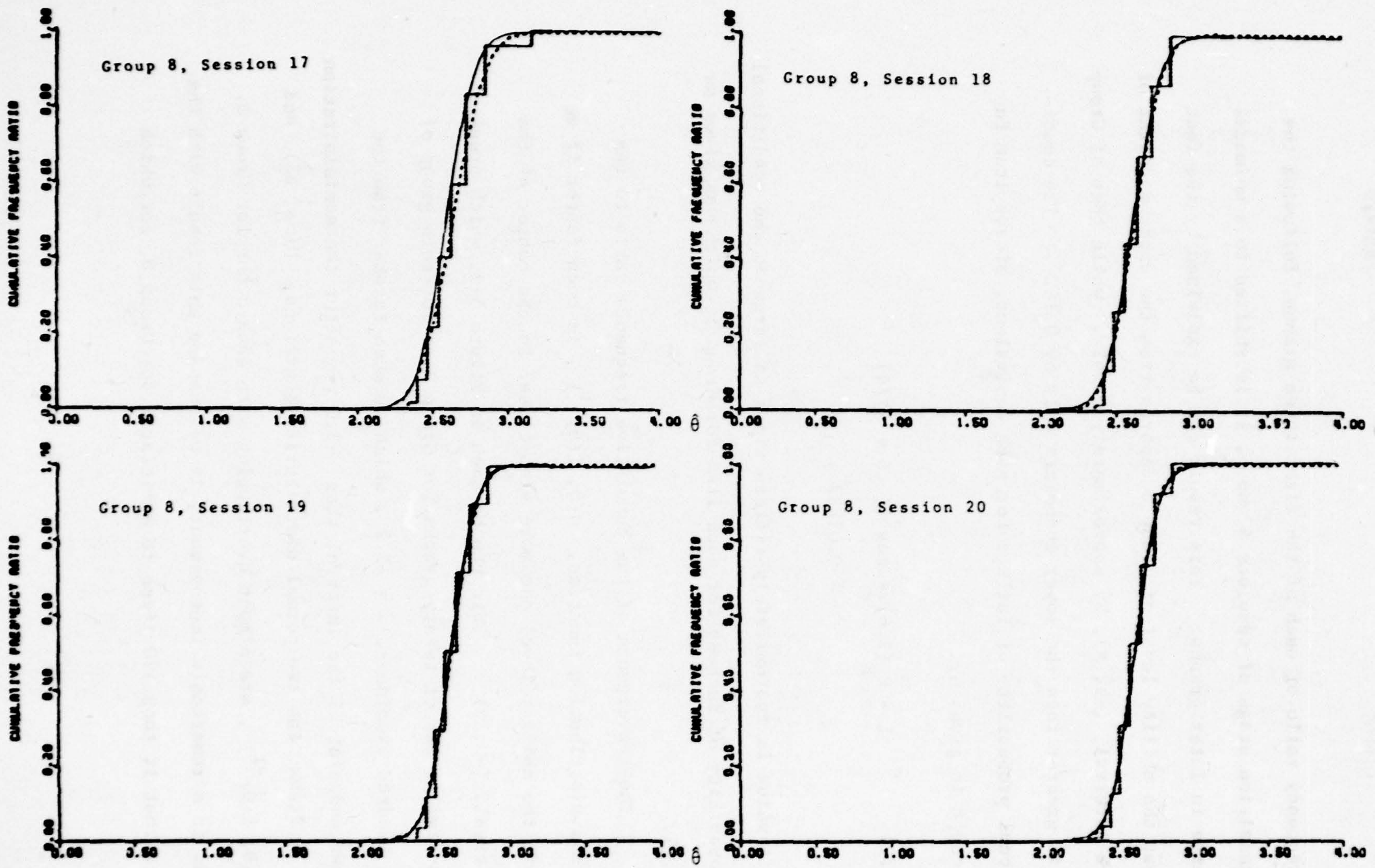

FIGURE 3-2 (Continued)

frequency ratio of each of the first three graphs, following the transition stage of sessions 4 and 5, it is shifted to a unimodal curve in later graphs. This result can be explained by the fact that the ability level of Group 8 departs from the upper endpoint of the interval, $(-\pi, \pi)$, by approximately 0.542 , while that of Group 1 is greater than the lower endpoints only by 0.142 . The conditional probability of failure for each equivalent, binary item for Group 8 is given by

$$(3.2) \qquad 1 - P_g(2.6) = \cos^2[(2.6 + \pi)/4] \doteq 0.01822 \ .$$

This value is approximately fifteen times as large as the conditional probability of success for each item for Group 1, which was given as (3.1).

The convergence of the cumulative frequency ratio to the normal distribution function, $N(\theta, I(\theta)^{-1})$, is much faster if we shift the ability level one more step closer to the center of the interval, $(-\pi, \pi)$. This can be seen in Figure 3-3, which presents the similar set of twenty graphs for Group 2. For this group of one hundred examinees, $\theta = -2.2$, which is much farther from the lower endpoint of the interval than -3.0 . After the administration of 70 items, the two normal distribution functions, $N(m_{\hat{\theta}}, s^2_{\hat{\theta}})$ and $N(\theta, I(\theta)^{-1})$, are almost overlapping with each other for Group 2. This is a remarkable improvement, if we compare this result with the fact that it took 170 items to administer for Group 8, for which

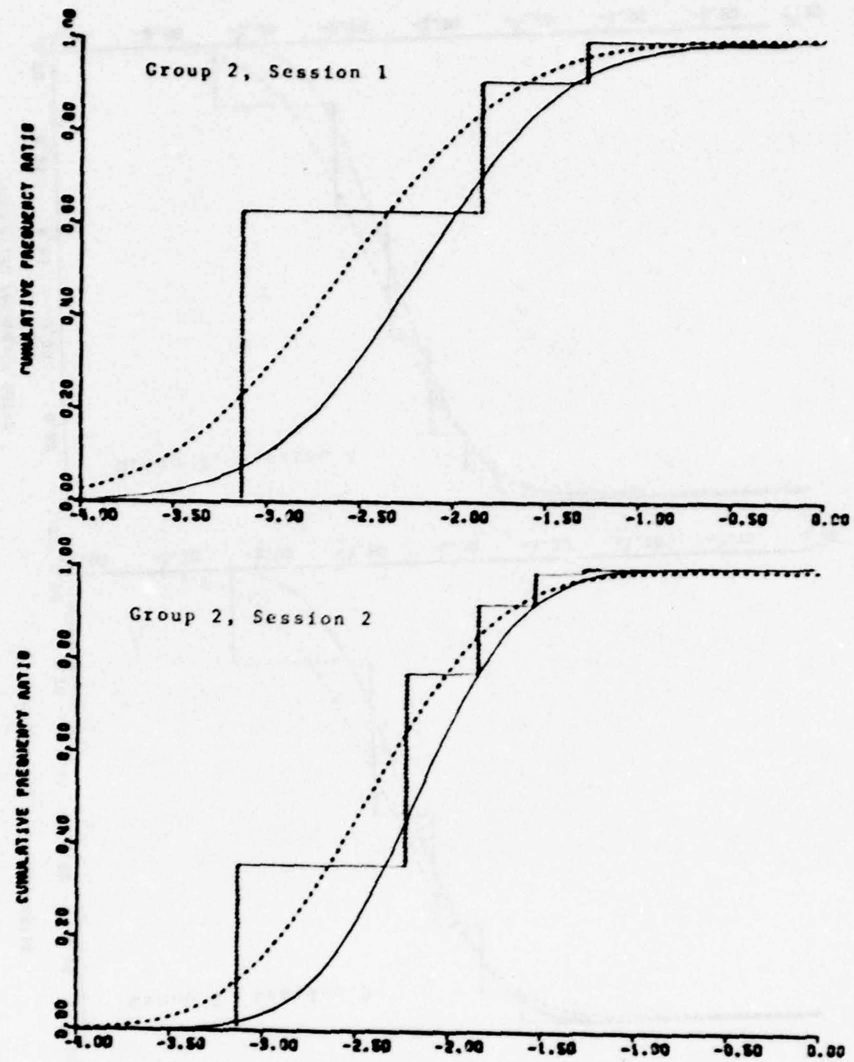

FIGURE 3-3

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -2.2$

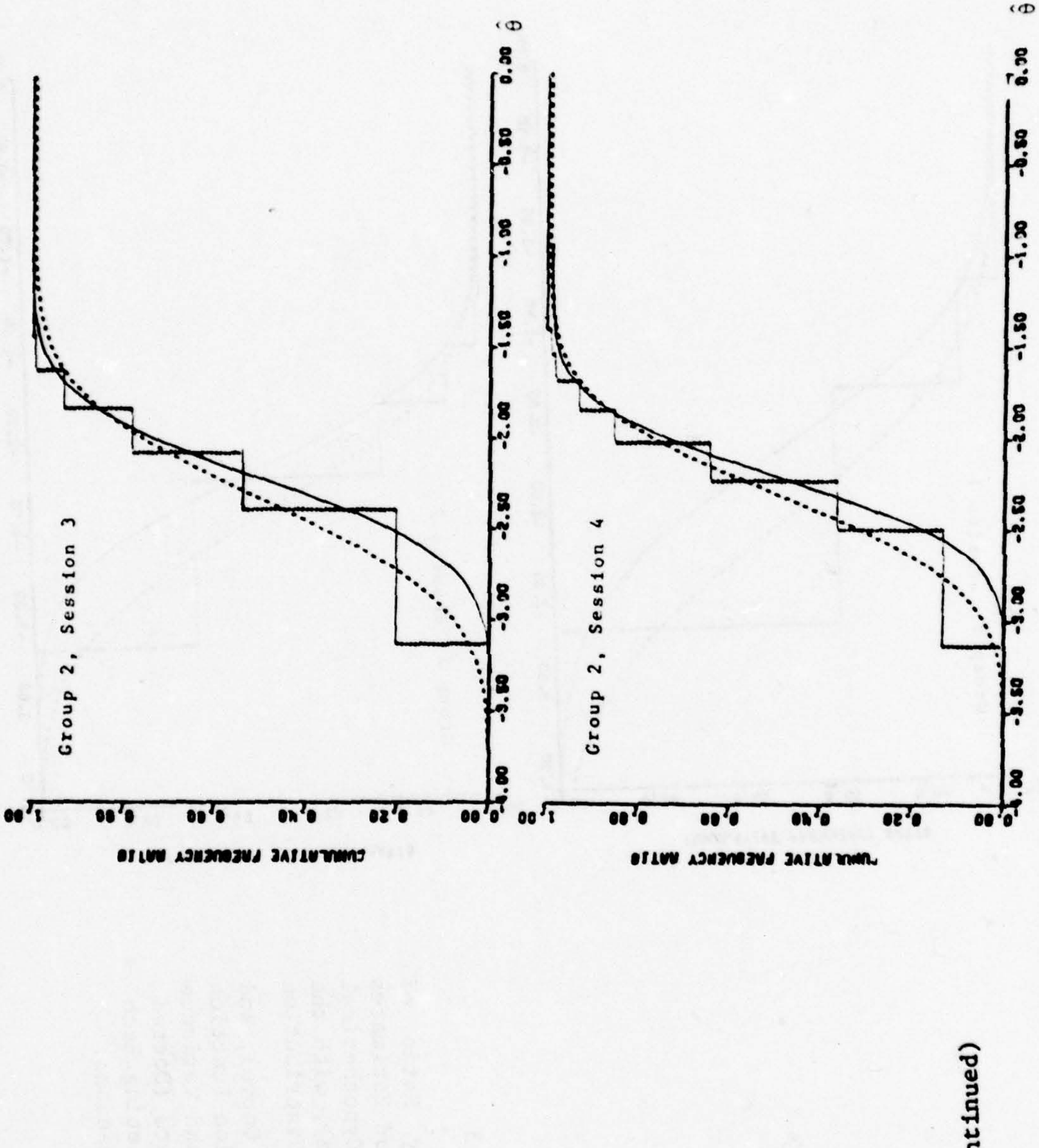

FIGURE 3-3 (Continued)

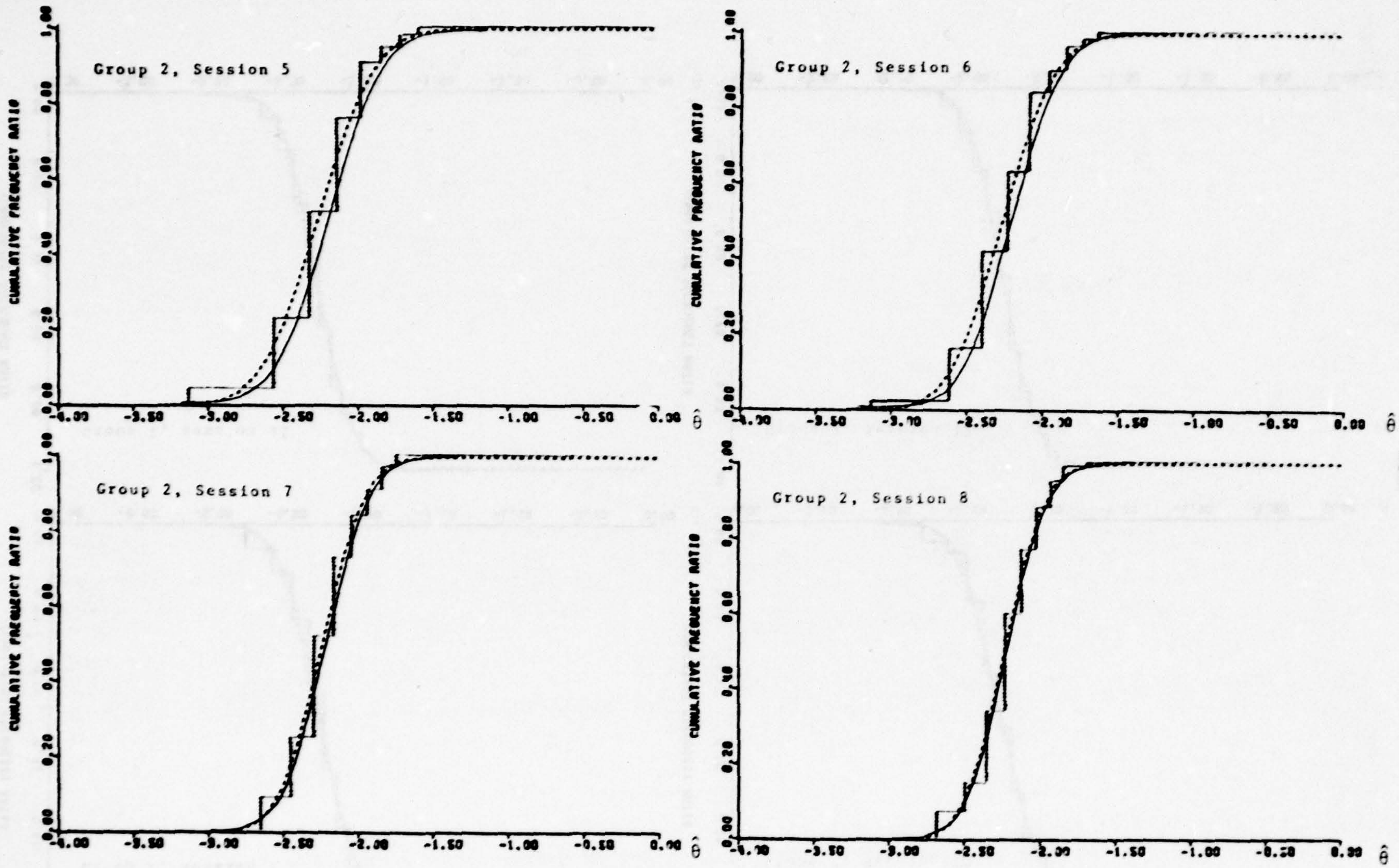

FIGURE 3-3 (Continued)

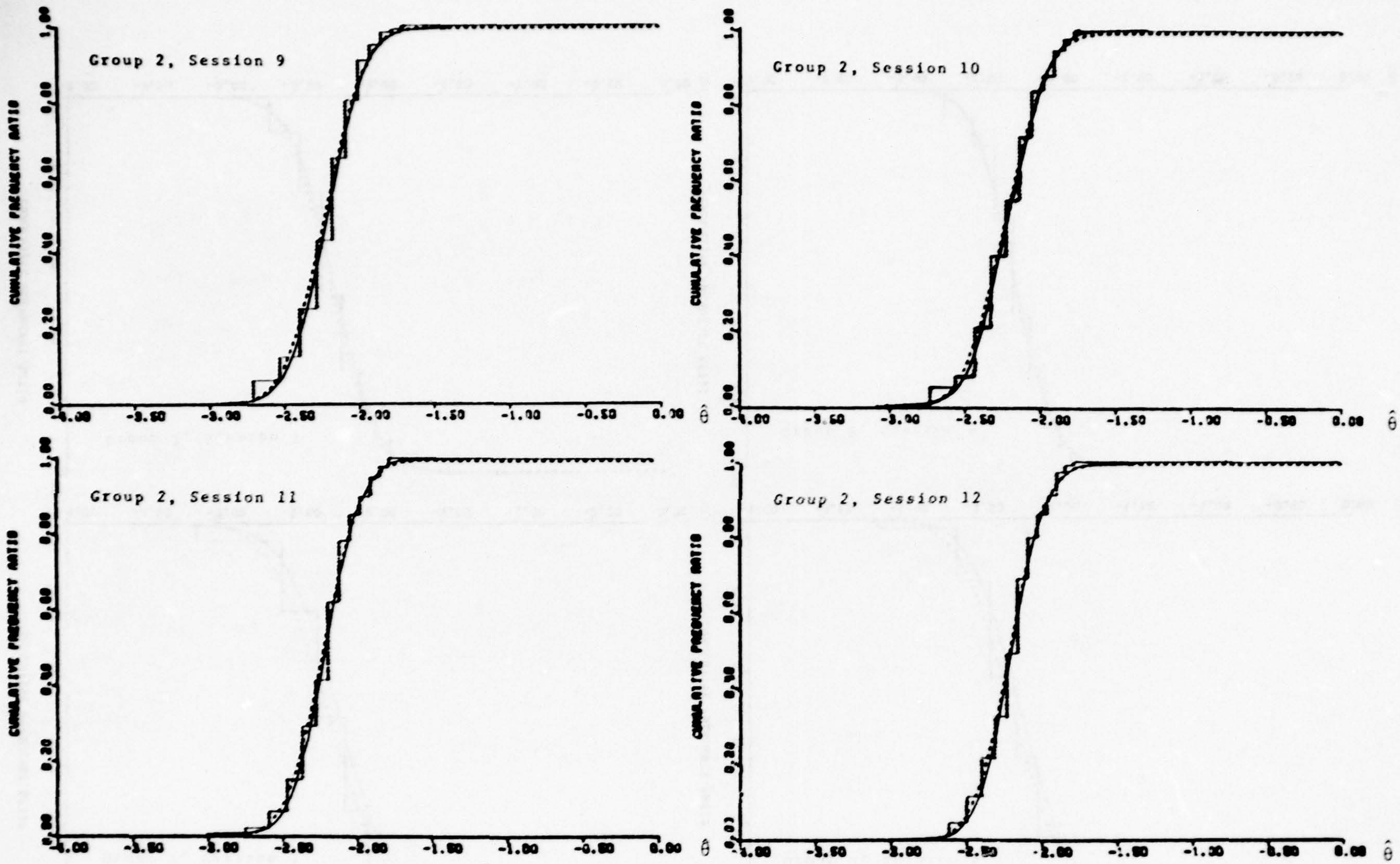

FIGURE 3-3 (Continued)

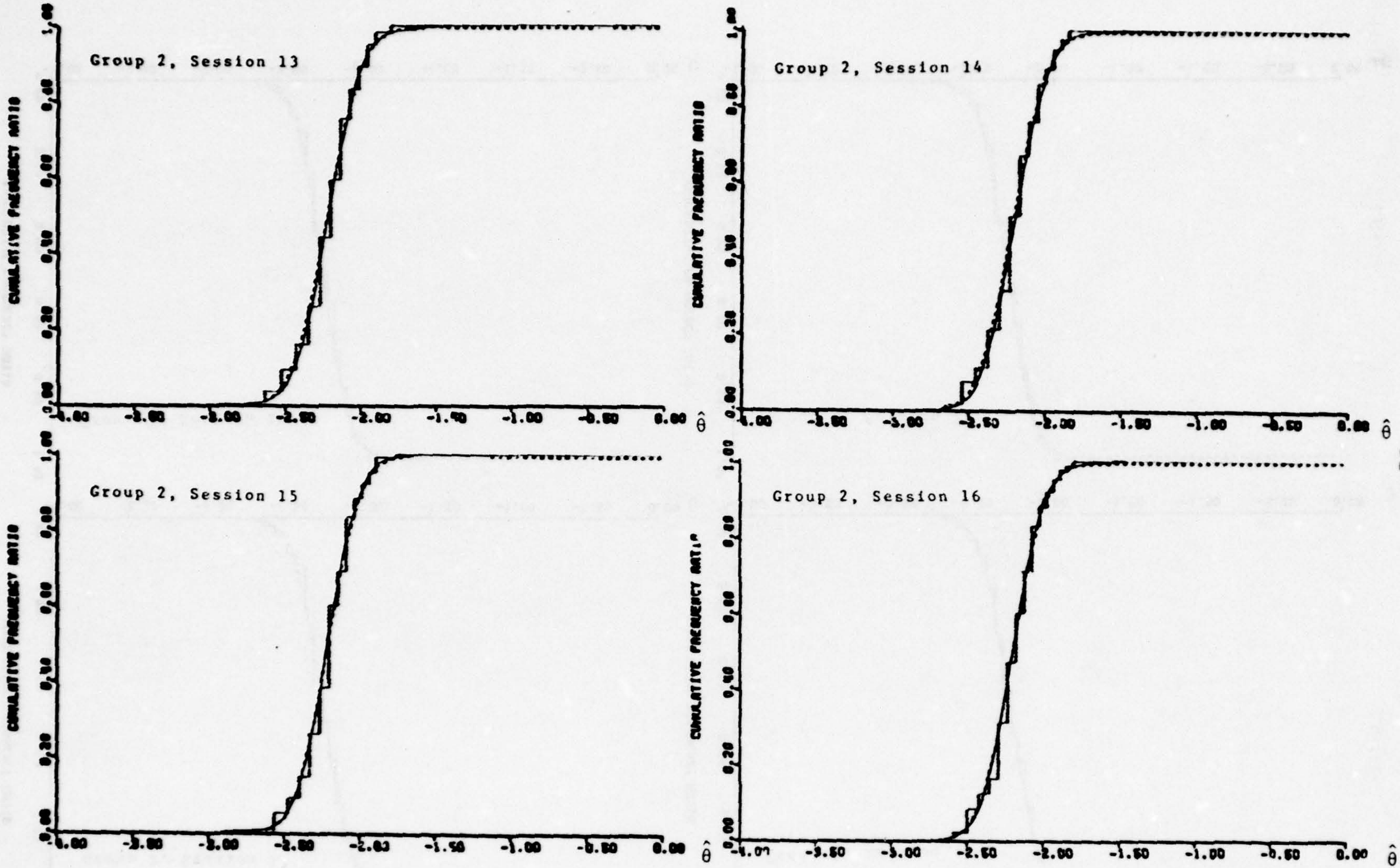

FIGURE 3-3 (Continued)

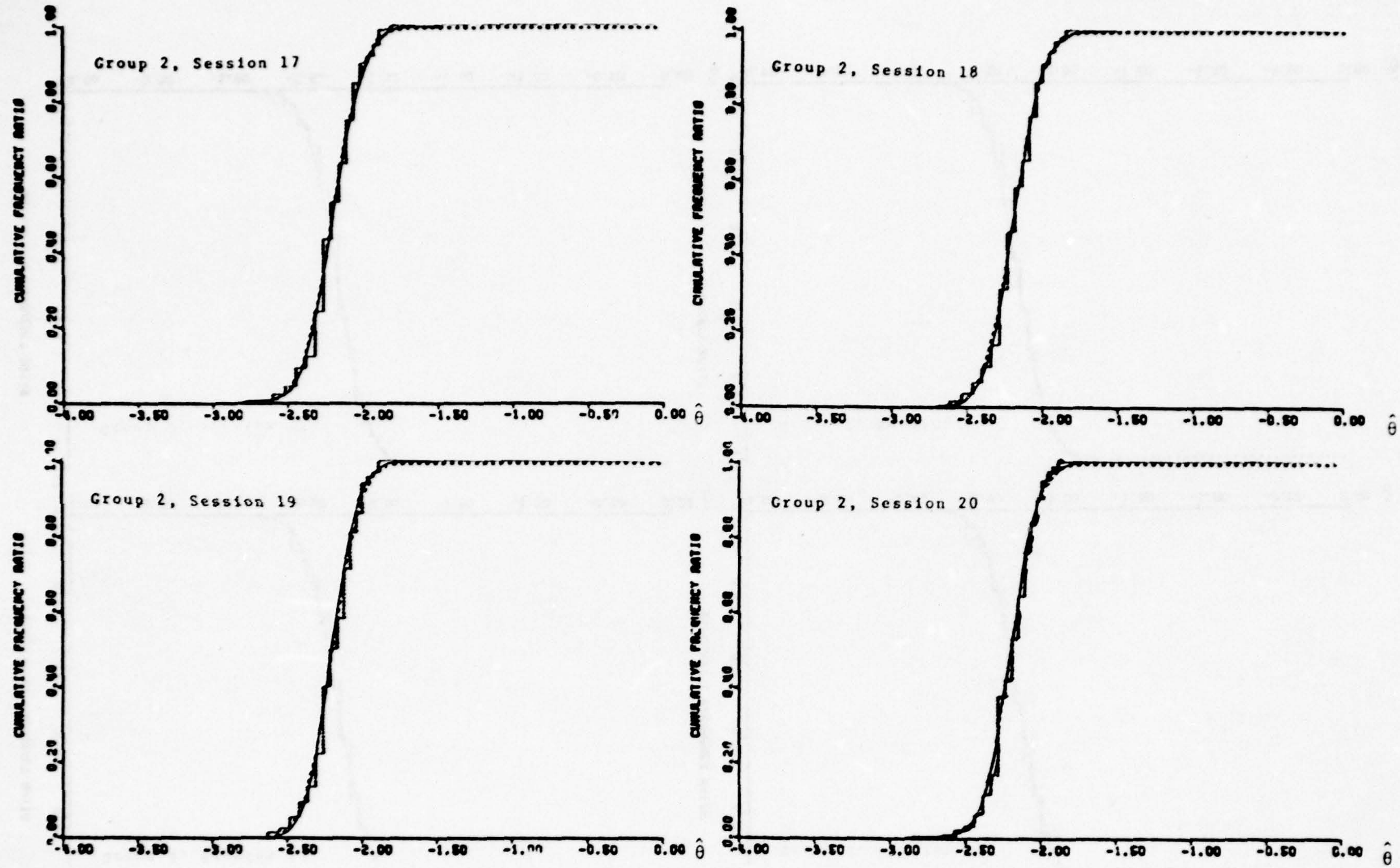

FIGURE 3-3 (Continued)

$\theta = 2.6$, to achieve this level of closeness. A J-shape frequency distribution of the maximum likelihood estimate is indicated by the cumulative frequency ratio only in the first graph of Figure 3-3, i.e., after ten items have been administered to the examinees, and, after that, unimodal frequency distributions are observed.

The remarkable improvement in the speed of convergence of the cumulative frequency ratio of one hundred maximum likelihood estimates for Group 2 in comparison with Group 8 can be explained from the difference between the conditional probability of success for Group 2 and that of failure for Group 8 . The former conditional probability is given by

$$(3.3) \qquad P_g(-2.2) = \sin^2[(-2.2 + \pi)/4] \doteq 0.05440 \ ,$$

whereas the latter conditional probability was already obtained in (3.2), which is approximately one-third of $P_g(-2.2)$. This difference between the two conditional probabilities indicates that the probability with which the examinee of Group 2 obtains the strictly decreasing likelihood function with the terminal maximum at $\theta = -\pi$ is much smaller than the one with which the examinee of Group 8 obtains the strictly increasing likelihood function with the terminal maximum at $\theta = \pi$, especially when the number of items is substantially large.

So far we have observed the results of the three groups of one hundred examinees whose ability levels are close to one of the

endpoints of the interval, $(-\pi, \pi)$. In contrast to those results, we shall observe a similar set of twenty graphs for Group 5, for which $\theta = 0.2$, i.e., closest to the center of the interval. Figure 3-4 presents these results.

We can see in this figure that, even in the first graph, or after the administration of only ten items, the two normal distribution functions, $N(m_{\hat{\theta}}, s^2_{\hat{\theta}})$ and $N(\theta, I(\theta)^{-1})$, are very close. We also notice that there are more varieties of different values of the maximum likelihood estimate, and thus the cumulative frequency ratio is much smoother, in earlier graphs, in comparison with those for the other three groups we observed earlier. There is no doubt that the speed of convergence of the distribution of the maximum likelihood estimate to the normality is much higher on this level of θ .

Similar sets of twenty graphs for the remaining four groups, Groups 3, 4, 6 and 7 , are presented in Appendix I as Figures A-1-1, A-1-2, A-1-3 and A-1-4, respectively. We can say from these results that, except for Group 7, whose ability level is 1.8 , the speed of convergence of the cumulative frequency ratio of the maximum likelihood estimate is quite high. The conditional probability of success in one binary item for each of these four groups of subjects is given in Table 4-4 which will be presented in the next section.

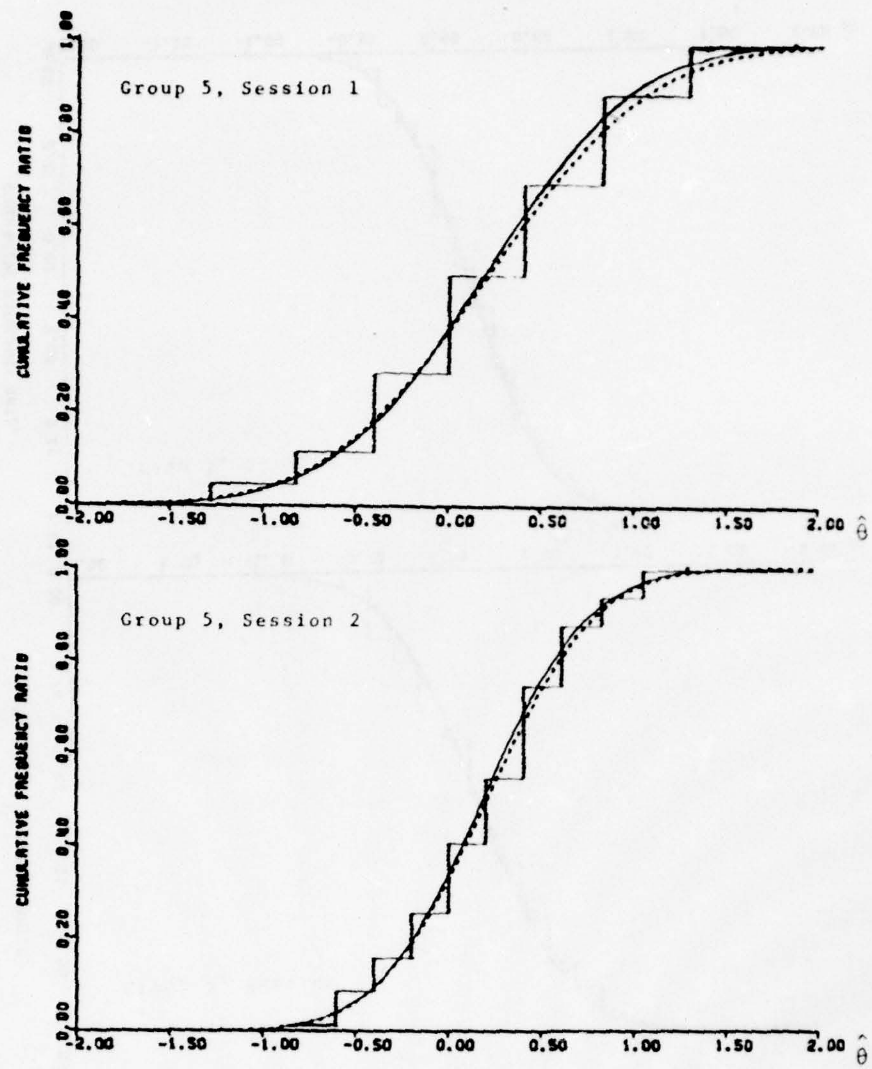

FIGURE 3-4

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 0.2$

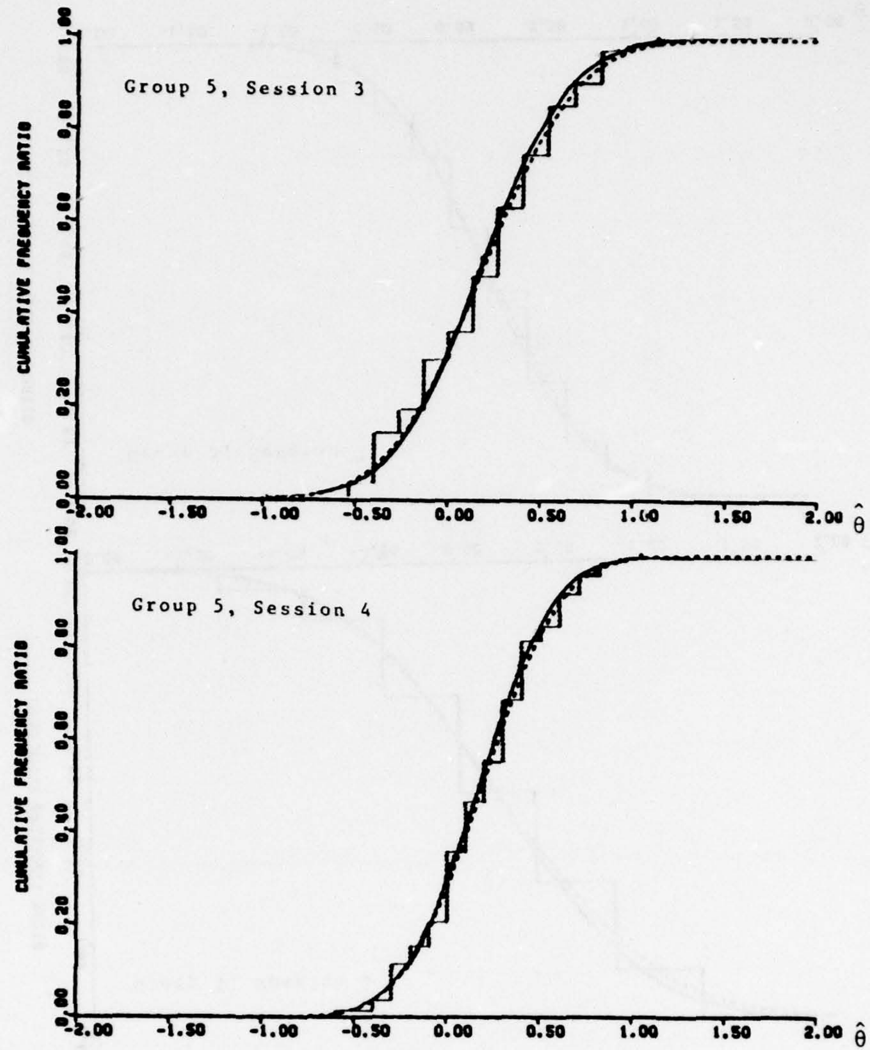

FIGURE 3-4 (Continued)

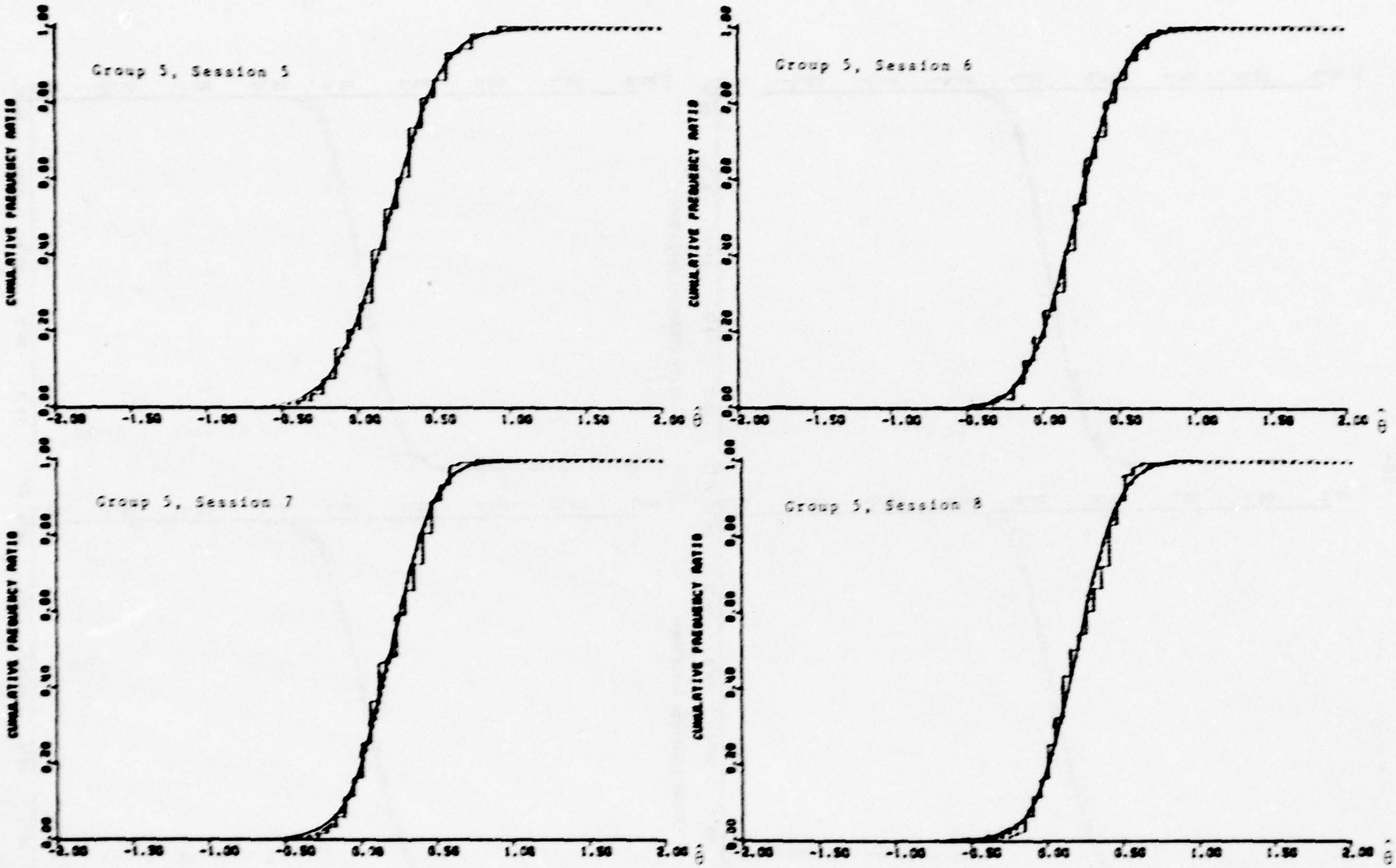

FIGURE 3-4 (Continued)

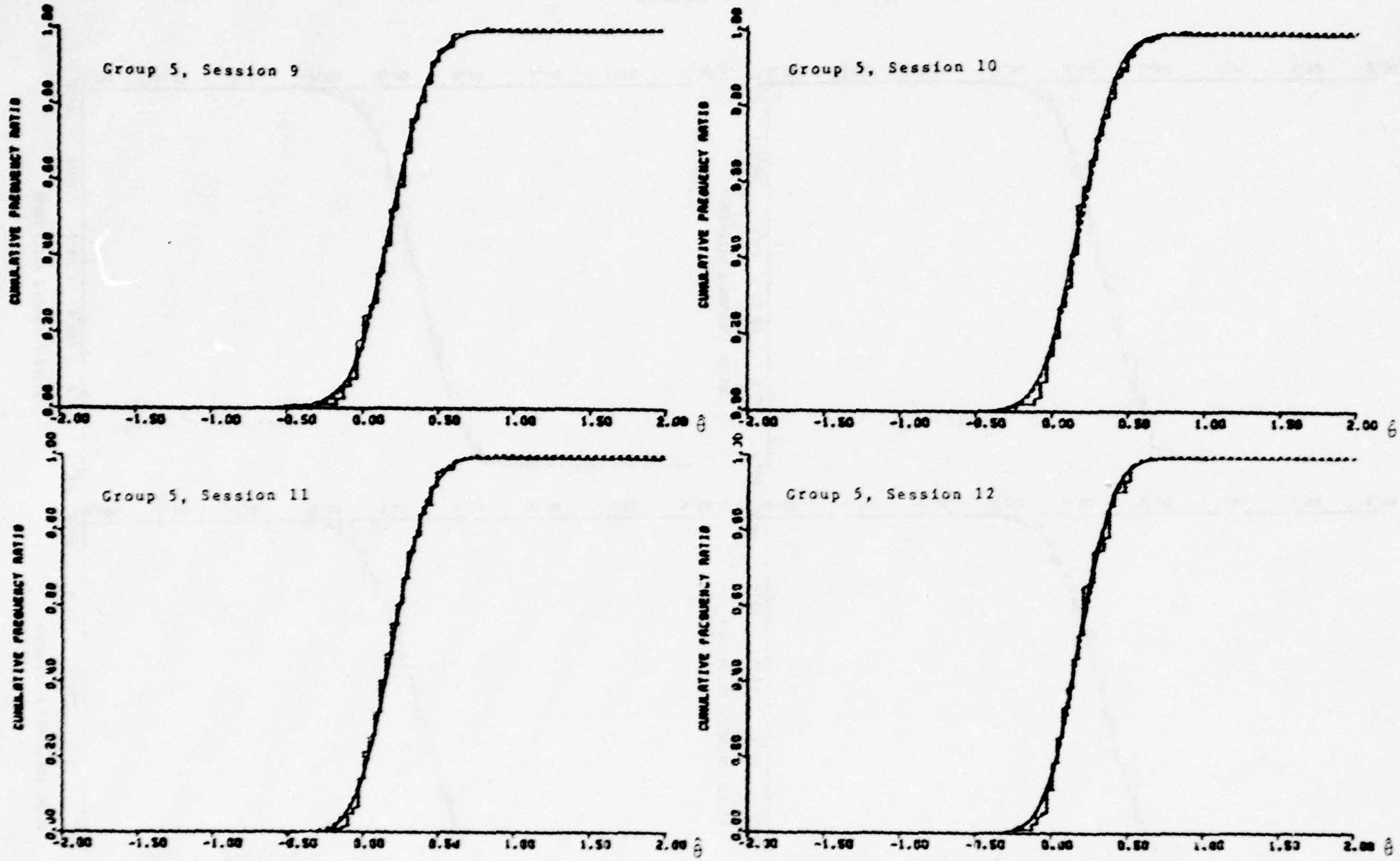

FIGURE 3-4 (Continued)

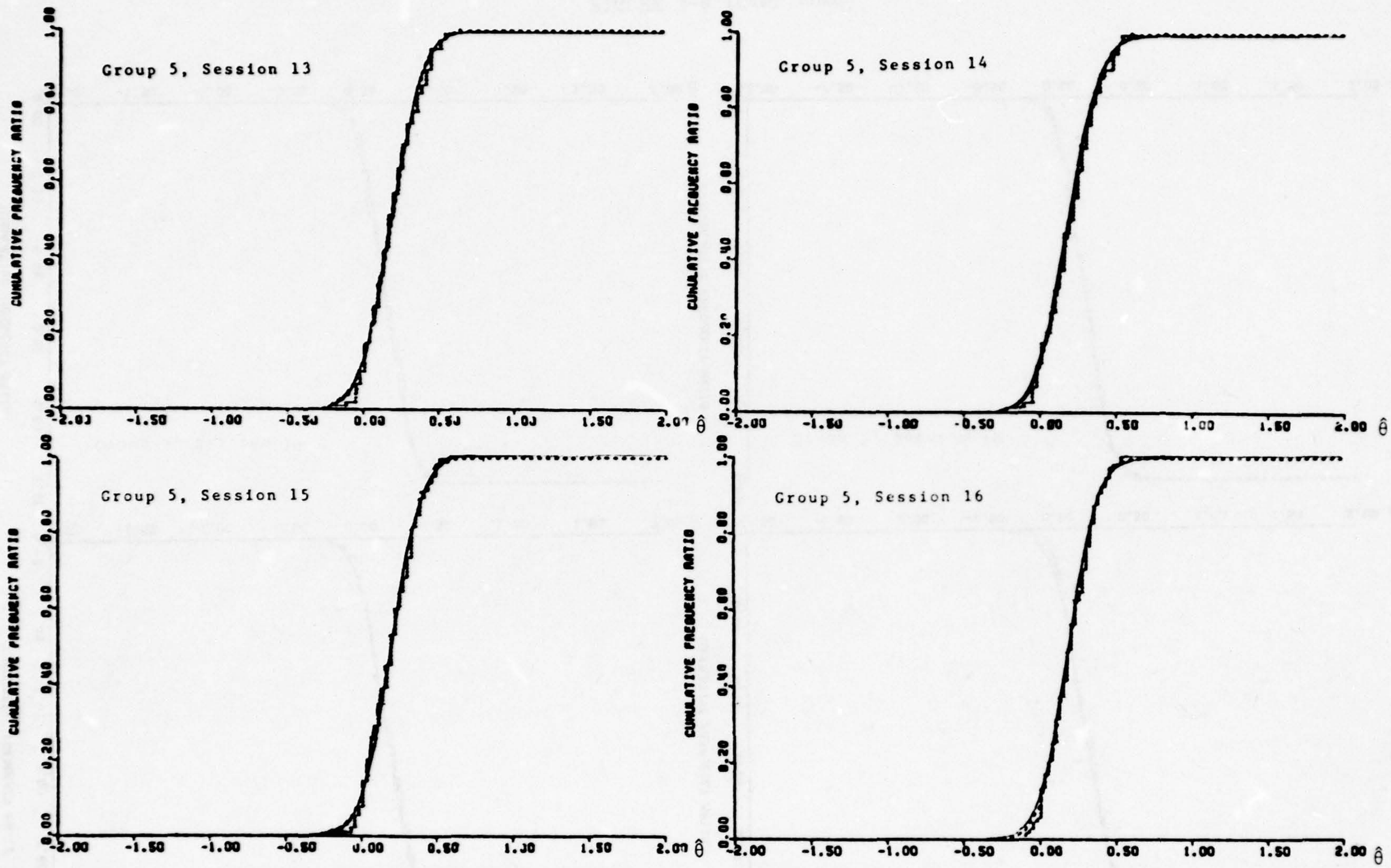

FIGURE 3-4 (Continued)

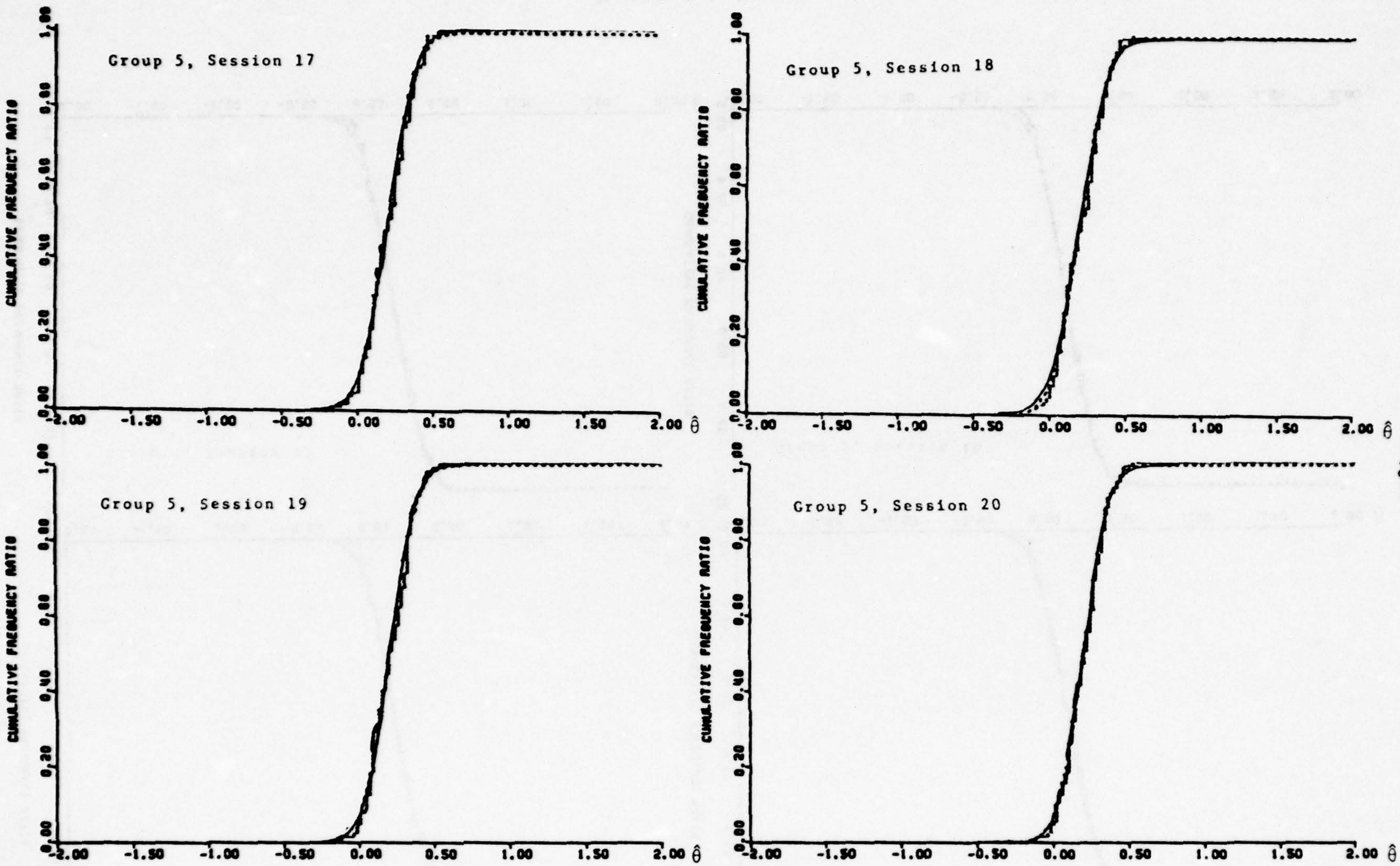

FIGURE 3-4 (Continued)

IV Further Observation of the Results

We have observed the sample mean, $m_{\hat{\theta}}$, and the sample standard deviation, $s_{\hat{\theta}}$, of the one hundred maximum likelihood estimates of each of the eight groups of examinees, after the completion of each of the twenty sessions of testing. We have also observed the cumulative frequency ratio in each case, in comparison with the normal distribution function, $N(\theta, I(\theta)^{-1})$. For further observation, here we consider the skewness index, $c_{1\hat{\theta}}$, which is defined by

(4.1) $$c_{1\hat{\theta}} = m_{3\hat{\theta}} \, s_{\hat{\theta}}^{-3} ,$$

where $m_{3\hat{\theta}}$ is the third sample moment about the mean, given by

(4.2) $$m_{3\hat{\theta}} = (1/100) \sum_{i=1}^{100} (\hat{\theta}_i - m_{\hat{\theta}})^3 .$$

Table 4-1 presents the value of this sample skewness index, $c_{1\hat{\theta}}$, for the set of the one hundred maximum likelihood estimates of each of the eight groups of examinees, obtained after the completion of each of the twenty sessions. From (4.1), it is obvious that a positive value in the table indicates a positive skewness, and a negative value means a negative skewness. In this table, again the three marks, ***, ** and * , are assigned to some of the entries. The first mark is attached to all the values of $c_{1\hat{\theta}}$, whose absolute values are greater than or equal to 1.5 , the second one is for those the absolute values of which are greater than or equal to 1.0 and less than 1.5 , and the third one is assigned to those whose absolute values are greater than or equal to 0.5 and less than

TABLE 4-1

Sample Skewness Index of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8
θ / Session	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	---	0.770*	-0.782*	-0.622*	-0.120	0.668*	-0.071	-1.196**
2	---	-0.134	-0.272	-0.367	-0.052	0.599*	0.735*	-0.786*
3	---	-0.544*	-0.720*	0.071	0.071	0.058	0.829*	-0.267
4	---	-0.676*	-0.431	0.317	0.130	-0.111	0.771*	-0.033
5	9.849***	-0.626*	-0.545*	0.241	0.225	-0.105	0.762*	0.110
6	4.129***	-0.339	-0.526*	0.090	0.070	-0.007	-0.046	0.344
7	3.705***	0.050	-0.502*	0.078	0.074	-0.376	0.022	0.506*
8	3.705***	-0.245	-0.451	0.156	0.141	-0.275	0.026	0.497
9	3.705***	-0.371	-0.382	0.218	0.349	-0.328	0.064	0.609*
10	3.371***	-0.277	-0.345	0.140	0.597*	-0.311	-0.033	0.717*
11	2.865***	-0.237	-0.382	0.222	0.459	-0.132	-0.177	0.664*
12	2.667***	-0.167	-0.249	0.433	0.421	-0.022	0.022	0.709*
13	2.577***	-0.183	-0.367	0.246	0.389	-0.020	0.066	0.801*
14	2.271***	-0.214	-0.406	0.198	0.242	-0.029	0.182	0.851*
15	1.912***	-0.122	-0.355	0.252	0.212	-0.115	0.266	0.862*
16	1.545***	-0.157	-0.293	0.255	0.152	-0.064	0.308	0.899*
17	1.500***	-0.121	-0.407	0.015	0.068	-0.324	0.154	0.938*
18	1.448**	-0.183	-0.490	0.048	0.027	-0.232	0.228	0.587*
19	1.380**	-0.316	-0.445	0.193	0.055	-0.048	0.172	0.697*
20	1.189**	-0.271	-0.443	0.187	0.067	-0.032	0.200	0.287

* $0.5 \leq |c_{1\hat{\theta}}| < 1.0$

** $1.0 \leq |c_{1\hat{\theta}}| < 1.5$

*** $1.5 \leq |c_{1\hat{\theta}}|$

1.0 . We notice that the first four entries of the column of Group 1 in the table are indeterminate, since both the third and second moments about the mean are zero in each of these four cases.

It is interesting to note that, for Group 2, the sign of the index is reversed between the first and second sessions, and, for Group 8, it is reversed between the fourth and fifth sessions, while it is consistently positive for Group 1. Unlike Tables 3-1 and 3-2, which were presented in the preceding section and are for the sample mean and the sample standard deviation, respectively, the configuration of the values of the sample skewness index in Table 4-1 is somewhat more complicated and seemingly more difficult to interpret.

This problem of interpretation will be solved, however, if we pay attention to the frequencies of the two extreme values of the maximum likelihood estimate, $-\pi$ and π . Table 4-2 presents the frequency distribution of these two values for each group and for each session. In this table, the numbers appearing in the first four columns are the freqencies of $-\pi$, and those in the last three columns are those of π . For Group 5, the frequencies are zero for both $-\pi$ and π throughout the twenty sessions.

We can see in Table 4-2 that, for Group 1, even after the administration of 200 items, the terminal maximum for the likelihood function at the lower end of the interval $(-\pi, \pi)$ occurred 73 times out of 100 . This explains the J-shape cumulative frequency ratios of the maximum likelihood estimate for Group 1 throughout the

TABLE 4-2

Frequencies of $-\pi$ As the Maximum Likelihood Estimate Appearing in the First 4 Columns and Those of π Appearing in the Last 3 Columns. The Total Number of Maximum Likelihood Estimates in Each Cell is 100.

Group	1	2	3	4	5	6	7	8
Session \ θ	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	100	62	13	3	0	8	37	75
2	100	35	1	0	0	1	11	66
3	100	20	1	0	0	0	5	52
4	100	13	0	0	0	0	2	43
5	99	4	0	0	0	0	1	39
6	95	2	0	0	0	0	0	30
7	94	0	0	0	0	0	0	26
8	94	0	0	0	0	0	0	23
9	94	0	0	0	0	0	0	20
10	93	0	0	0	0	0	0	15
11	91	0	0	0	0	0	0	14
12	90	0	0	0	0	0	0	12
13	89	0	0	0	0	0	0	10
14	87	0	0	0	0	0	0	9
15	84	0	0	0	0	0	0	6
16	80	0	0	0	0	0	0	6
17	79	0	0	0	0	0	0	4
18	78	0	0	0	0	0	0	1
19	76	0	0	0	0	0	0	1
20	73	0	0	0	0	0	0	0

twenty sessions of testing, as we have observed in the preceding section. On the other hand, a close observation of the relationship between the skewness indices and the frequencies of the two extreme values of the maximum likelihood estimate reveals that, for Groups 8, 2 and 7 , the reversal of the sign of the skewness index occurs somewhere around the frequency 40 of the extreme values of the maximum likelihood estimate. Why is it so?

To answer this question, we must call our attention to the fact that there is a substantial gap between one of the extreme values of the maximum likelihood estimate and the adjacent one. To be more specific, for Session 1, or after the administration of 10 items, the value of the maximum likelihood estimate corresponding to the second best test score, 9 , is 1.8546 , which is obtained through (2.5) with $k = 1$. Thus the difference of this value of the maximum likelihood estimate from π is as large as 1.2870 . The same amount of discrepancy exists between $-\pi$ and the adjacent maximum likelihood estimate, -1.8546 , which corresponds to the second lowest test score, 1 . Even for Session 20, or after all the 200 items have been administered, this discrepancy is still as large as 0.2831 , since the maximum likelihood estimate corresponding to the second highest test score, 199 , is 2.8585 , and the one corresponding to the second lowest test score, 1 , is -2.8585 .

We notice that, when $-\pi$, one of the two extreme values of the maximum likelihood estimate, has a high frequency, it makes the total frequency distribution of the maximum likelihood estimate

J-shaped, causing a positive skewness to it. On the other hand, when such an extreme value has a low frequency, because of the long distance from the adjacent value of the maximum likelihood estimate, it creates a long tail on the left hand side of the total frequency distribution, and, therefore, causes a negative skewness to the frequency distribution. We can easily see that the same logic applies for the frequency of the other extreme value, π , of the maximum likelihood estimate, and negative and positive skewnesses. Considering these facts, we are in a good position to understand the meaning of the total configuration of the skewness indices in Table 4-1. It should also be pointed out that those which involve neither of the two extreme values, $-\pi$ and π , of the maximum likelihood estimate are small enough to be considered as sampling fluctuations. In fact, only a few of them are marked with * , and none of the others exceeds 0.5 in absolute value.

If we combine the result in Table 4-1 with the sample means of the maximum likelihood estimate, which are given in Table 3-1 in the preceding section, the effect of the two extreme values of the maximum likelihood estimate is more conspicuous. We notice that all the sample means, which involve one or more $-\pi$ or π , are shifted from the true values of θ to the directions indicated by the signs of the extreme values. It is also noted that all the sample means, which involve neither $-\pi$ nor π , have very small discrepancies from the true values of θ , i.e., less than 0.05 in absolute value.

Table 4-3 presents the kurtosis index, $c_{2\hat{\theta}}$, which is defined by

$$(4.3) \qquad c_{2\hat{\theta}} = m_{4\hat{\theta}} \, s_{\hat{\theta}}^{-4} - 3 \ ,$$

where $m_{4\hat{\theta}}$ is the fourth sample moment of the one hundred maximum likelihood estimates, for which we can write

$$(4.4) \qquad m_{4\hat{\theta}} = (1/100) \sum_{i=1}^{100} (\hat{\theta}_i - m_{\hat{\theta}})^4 \ ,$$

for each of the eight groups of examinees after the completion of each of the twenty sessions. The three types of marks, ***, ** and * , are assigned in this table by following the same rule as we have used for the skewness index in Table 4-1. As is well known, this kurtosis index is defined in comparison with the normal distribution, i.e., a positive value indicates a greater peakedness, and a negative value a lesser peakedness, than the normal distribution.

We notice that, again in these results, there exists a certain effect of the extreme values, $-\pi$ and π , of the maximum likelihood estimate. In fact, we observe two different transitions there, one of which is from positive to negative values, and the other from negative to positive values. The former transition stage corresponds, approximately, to the frequency 75 of $-\pi$ or π , and the latter transition stage corresponds, roughly, to the frequency 13 . Sampling fluctuations appear to be greater for the kurtosis index than for the skewness index, the fact which coincides with

TABLE 4-3

Sample Kurtosis Index of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees of Each of the Eight Ability Levels, after Completing Each of the Twenty Sessions of Testing.

Group	1	2	3	4	5	6	7	8
θ / Session	-3.0	-2.2	-1.4	-0.6	0.2	1.0	1.8	2.6
1	---	-0.866*	0.027	0.980*	-0.499	0.567*	-1.141**	-0.472
2	---	-1.278**	0.720*	0.270	-0.525*	1.576***	0.080	-1.184**
3	---	-0.617*	1.429**	-0.179	-0.699*	0.267	0.888*	-1.608***
4	---	0.124	0.940*	0.136	-0.296	0.084	1.291**	-1.505***
5	95.010***	1.299**	0.458	0.291	-0.308	-0.108	2.071***	-1.520***
6	15.053***	0.930*	0.310	-0.574*	-0.484	-0.326	-0.421	-1.142**
7	11.730***	-0.423	0.622*	-0.465	-0.817*	-0.236	0.087	-0.973*
8	11.730***	-0.010	0.087	-0.303	-0.703*	-0.394	0.225	-0.758*
9	11.730***	0.114	-0.477	-0.228	-0.192	-0.343	0.752*	-0.552*
10	9.361***	0.003	-0.317	-0.279	0.423	0.170	1.404**	-0.152
11	6.210***	0.021	-0.402	0.115	-0.212	0.414	0.608*	-0.085
12	5.111***	-0.307	-0.505*	0.242	-0.501*	0.349	0.298	0.183
13	4.893***	-0.117	-0.319	-0.052	-0.510*	0.517*	0.305	0.472
14	3.358***	-0.164	-0.119	0.030	-0.622*	1.405**	0.121	0.492
15	1.804***	0.034	-0.194	0.184	-0.767*	1.264**	-0.077	0.867*
16	0.499	-0.080	-0.303	0.293	-0.696*	0.659*	0.014	0.895*
17	0.424	0.027	-0.085	0.358	-0.746*	0.699*	0.170	1.278**
18	0.301	0.027	0.167	0.535*	-0.650*	0.375	-0.015	0.451
19	0.284	0.069	-0.042	0.306	-0.695*	-0.031	-0.007	0.858*
20	-0.236	-0.117	-0.307	0.793*	-0.483	0.276	0.092	-0.628*

* $0.5 \leq |c_{2\hat{\theta}}| < 1.0$

** $1.0 \leq |c_{2\hat{\theta}}| < 1.5$

*** $1.5 \leq |c_{2\hat{\theta}}|$

our general knowledge of greater sampling fluctuations for higher order moments.

Table 4-4 presents the conditional probability of success, $P_g(\theta)$, for a single item, which is given by (1.2), for each of the eight ability levels, together with the item information function $I_g(\theta)$, and three other item information functions obtainable after the transformation of θ to τ_1 , τ_2 and τ_3 through (2.6), (2.7) and (2.9), respectively. These item information functions are obtained by multiplying $I_g(\theta)$ with the square of the derivative of θ with respect to the corresponding transformed variables, respectively (cf. Samejima, 1979).

TABLE 4-4

Conditional Probability of Success, $P_g(\theta)$, in a Single Equivalent Item g, Item Information Function, $I_g(\theta)$, and Three Other Item Information Functions, $I^{*}_g(\tau_1)$, $I^{**}_g(\tau_2)$ and $I^{***}_g(\tau_3)$, Obtained After Transforming Ability θ to τ_1, τ_2 and τ_3, Respectively.

θ	$P_g(\theta)$	$I_g(\theta)$	$I^{*}_g(\tau_1)$	$I^{**}_g(\tau_2)$	$I^{***}_g(\tau_3)$
-3.0	0.001253	0.25	31.9762	0.0137	0.0036
-2.2	0.054396	0.25	0.7776	0.2364	0.1487
-1.4	0.177891	0.25	0.2735	0.4639	0.4227
-0.6	0.352240	0.25	0.1753	0.6041	0.6594
0.2	0.549917	0.25	0.1616	0.6330	0.7153
1.0	0.739713	0.25	0.2078	0.5471	0.5564
1.8	0.891663	0.25	0.4141	0.3581	0.2792
2.6	0.981779	0.25	2.2360	0.1118	0.0517

V Discussion and Conclusions

We have found out that the convergence of the cumulative frequency distribution of the maximum likelihood estimate to the normal distribution function, $N(\theta, I(\theta)^{-1})$, is substantially slower for the levels of ability close to one of the two endpoints of the interval, $(-\pi, \pi)$, in comparison with the levels of ability close to the center of the interval. It has become obvious that the frequency of one of the two extreme values, $-\pi$ and π , of the maximum likelihood estimate is a good indicator of the degree of convergence, since it affects, strongly, the moments of the frequency distribution. One important implication of this finding is that we should avoid using the normal distribution, $N(\theta, I(\theta)^{-1})$, as the approximation to the conditional distribution of the maximum likelihood estimate, unless there are a large enough number of items so that the conditional probability of the "all success" response pattern, and that of the "all failure" response pattern, are neglibly small.

To pursue this further, the conditional probability of the "all success" response pattern, and that of the "all failure" response pattern, were calculated from $P_g(\theta)$, which is presented for each of the eight different levels of ability in Table 4-4 of the preceding section. Since all the items are equivalent, these conditional probabilities are $P_g(\theta)^n$ and $[1 - P_g(\theta)]^n$, respectively. For $\theta = -3.0$, or the ability level of Group 1, when we increase the number of items to 256, 512, 1,024, 2,048 and 4,096, the conditional

probability of the "all failure" response pattern becomes 0.725, 0.526, 0.277, 0.077 and 0.006, respectively. This means that, even if more than 1,000 items are administered, we must expect approximately 28 examinees out of 100 will obtain the "all failure" response pattern, and we need more than 4,000 items to reduce it to 0.6 person out of 100 examinees. These outcomes are exactly the same for $\theta = 3.0$, when we consider the conditional probability of the "all success" response pattern. We may conclude, therefore, that for the values of θ 3.0 or greater in absolute value we should give up, totally, the idea of using the normal approximation to the conditional distribution of the maximum likelihood estimate. For $\theta = 2.6$, if we increase the number of items from 32 to 64, 128, 256 and 512, the conditional probabilities of the "all success" response pattern are 0.555, 0.308, 0.095, 0.009 and 0.00008, respectively. Thus we can say that, for this level of ability, if we use approximately 300 items, chances are slim for one person out of 100 examinees to obtain π as the maximum likelihood estimate. This number, 300, is still too large for practical purposes, however, and we must say that in the vicinity of $\theta = 2.6$, and also that of $\theta = -2.6$, the idea of using the normal approximation to the conditional distribution of the maximum likelihood estimate is unrealistic. The situation is much more ameliorated, however, if we switch to the ability level, $\theta = -2.2$. On this level of ability, for 8, 16, 32, 64 and 128 items, the conditional probabilities of the "all failure" response pattern are 0.639, 0.409, 0.167, 0.028 and 0.0008 ,

respectively. Thus we can conclude that, as long as we have 100 items, it is unlikely to happen that one person out of one hundred examinees obtains $-\pi$ as his maximum likelihood estimate. This is well exemplified and supported by the result of our Monte Carlo study, which is given in Table 4-2 of the preceding section. In other words, we can be assured that 100 items are enough as far as we use the subinterval of θ, $(-2.2, 2.2)$, for which the normal approximation to the conditional distribution of the maximum likelihood estimate is adopted. This number of items will be reduced to half, i.e., 50, if we switch the subinterval of θ from $(-2.2, 2.2)$ to $(-1.8, 1.8)$, since for $\theta = 1.8$ the conditional probabilities of the "all success" response pattern are 0.632, 0.400, 0.160, 0.025 and 0.0006, for 4, 8, 16, 32 and 64 items, respectively. If we need to use, say, only 35 items, we must narrow down the interval further to $(-1.4, 1.4)$, for the conditional probabilities of the "all failure" response pattern at $\theta = -1.4$, or those of the "all success" response pattern at $\theta = 1.4$, are 0.676, 0.457, 0.209, 0.044 and 0.002 for 2, 4, 8, 16 and 32 items, respectively. We notice that the gain in the reduction of the number of items is decreasing compared with the amount of sacrifice in the interval length, and it is probably meaningless to consider further reductions of items. If we wish to use a set of "unknown" equivalent items as a substitute for the Old Test, it is advisable to aim at including 35 to 50 equivalent items in the new item pool. This can be done through the content analysis of the items, and their proportions

correct in the preliminary study, etc. As an additional information, the conditional probabilities of the "all success" response pattern for the ability levels 1.0, 0.6 and 0.2 , or those of the "all failure" response pattern for the ability levels -1.0, -0.6 and -0.2 , are: 0.547, 0.299, 0.090 and 0.008; 0.420, 0.176, 0.031 and 0.001; and 0.302, 0.091, 0.008 and 0.00007; for 2, 4, 8 and 16 items, respectively.

The conclusion made in the preceding paragraph is supported by the result of our Monte Carlo study, which was made in earlier sections. In the graph of Session 10 in Figure 3-3, that of Session 5 in Figure A-1-4, and that of Session 4 in Figure A-1-1, which involve 100 items for $\theta = -2.2$, 50 items for $\theta = 1.8$ and 40 items for $\theta = -1.4$, respectively, the normal distribution function, $N(\theta, I(\theta)^{-1})$ and the cumulative frequency ratio are sufficiently close. We find in Tables 3-1, 3-2, 4-1 and 4-3 that the sample mean, the sample standard deviation, the sample skewness index and the sample kurtosis index are: -2.232 [$\theta = -2.200$], 0.214 [$I(\theta)^{-1/2} = 0.200$], -0.277 and 0.003 in the first case, 1.810 [$\theta = 1.800$], 0.321 [$I(\theta)^{-1/2} = 0.283$], 0.762 and 2.071 in the second case, and -1.445 [$\theta = -1.400$], 0.330 [$I(\theta)^{-1/2} = 0.316$], -0.431 and 0.940 in the third case, respectively. We can say that, at least, the sample mean and the sample standard deviation are very close to the asymptotic values in each case.

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APPENDIX I

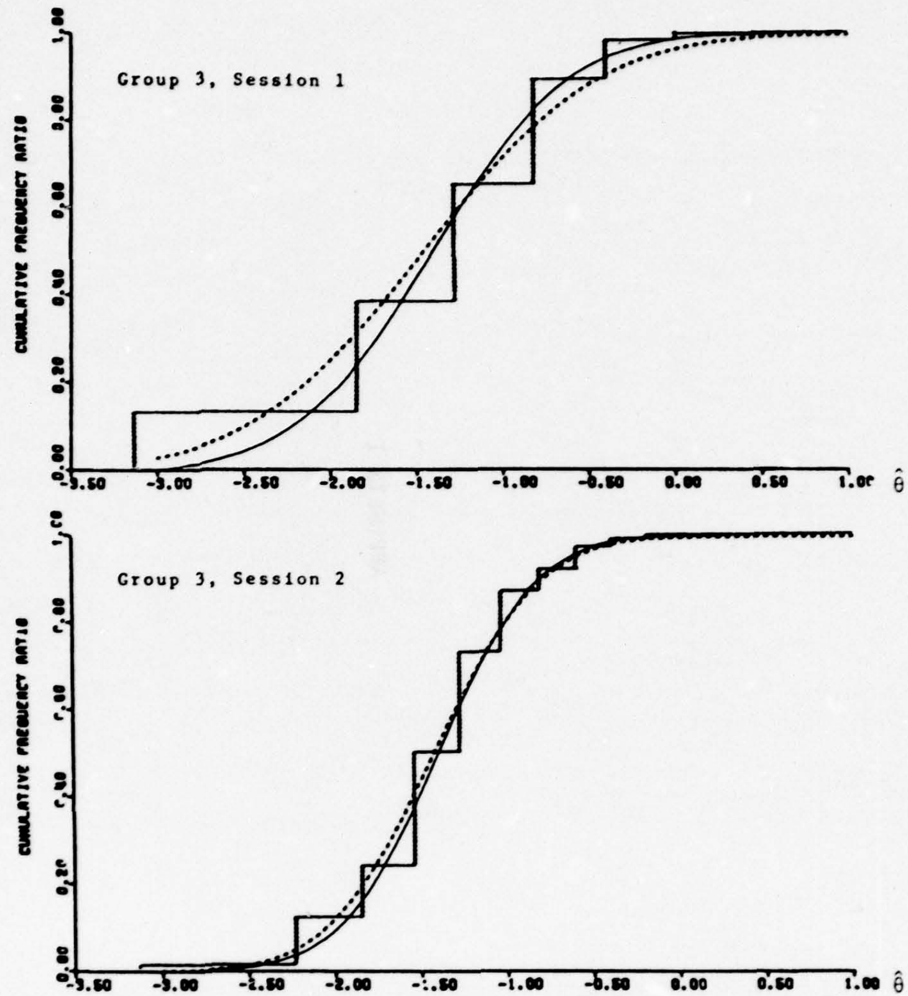


FIGURE A-1-1

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = -1.4$

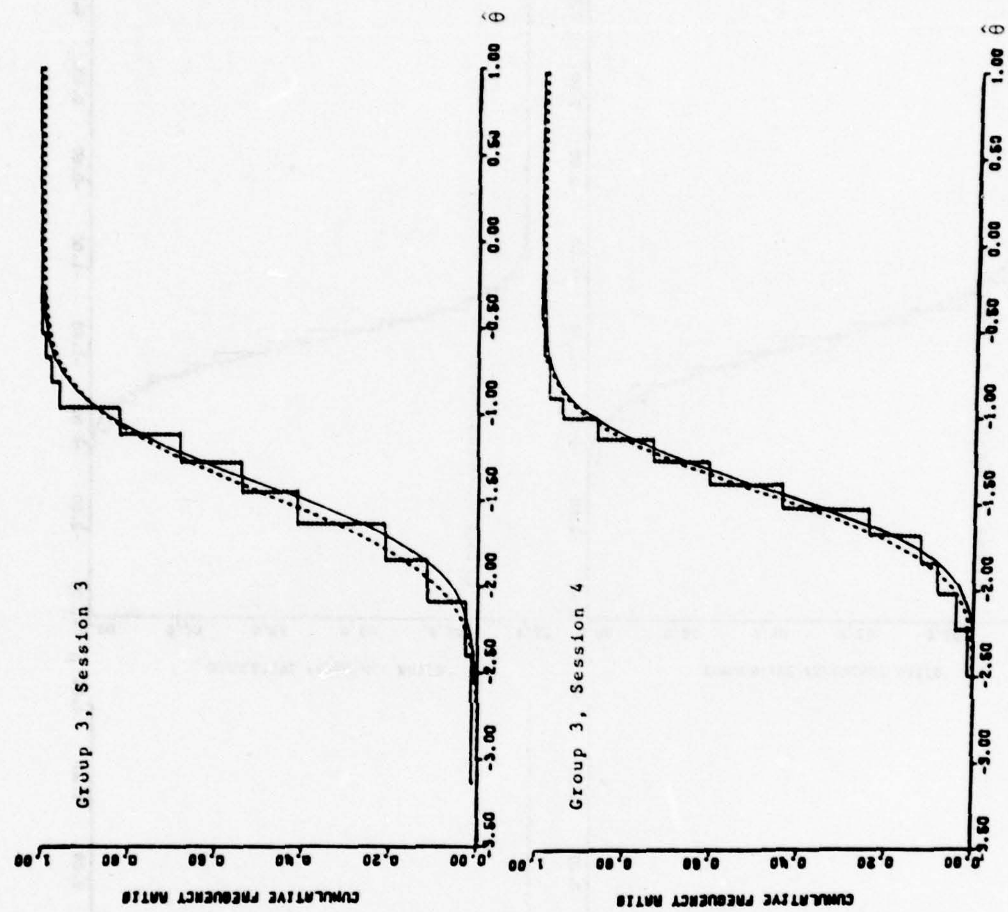
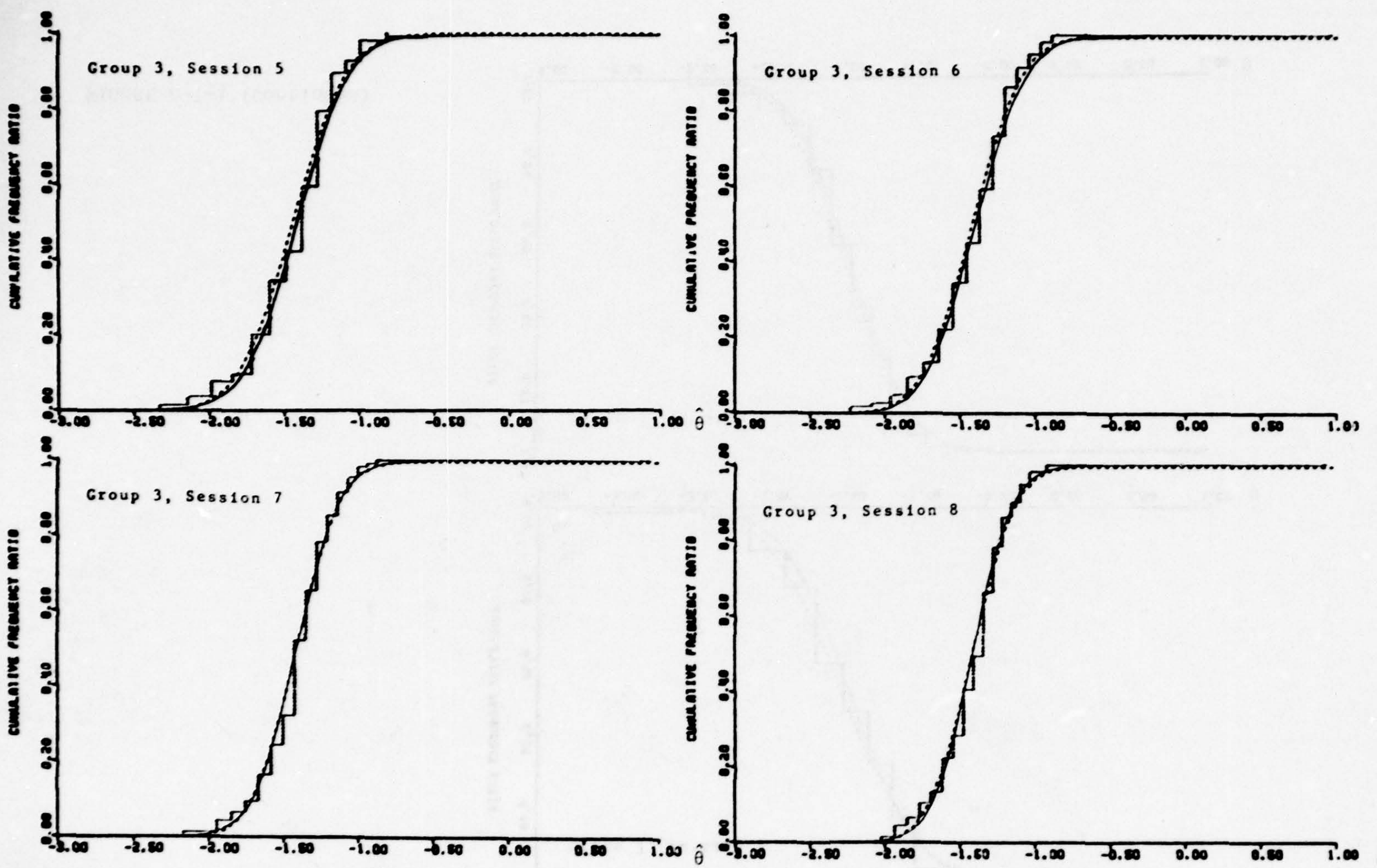


FIGURE A-1-1 (Continued)



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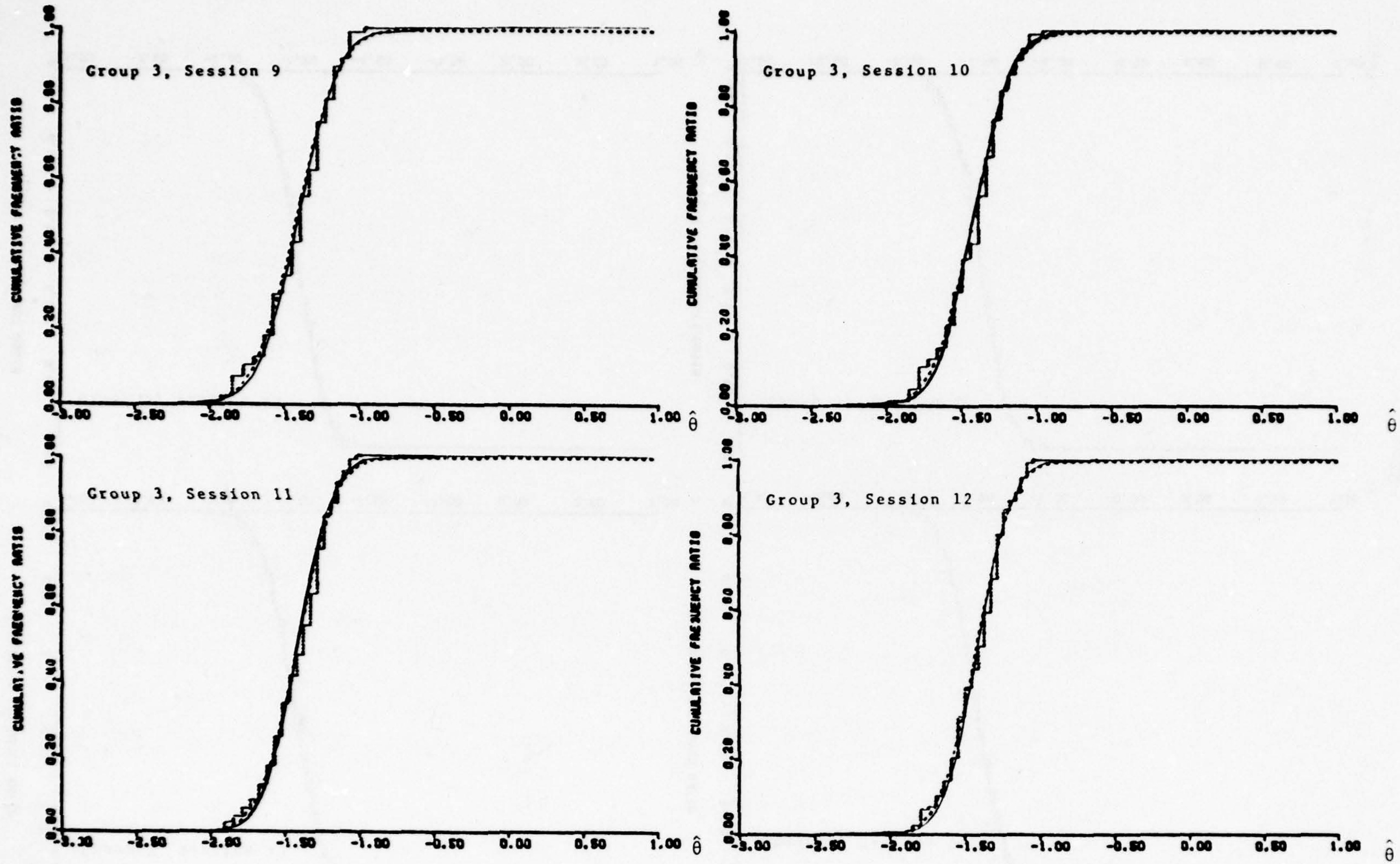

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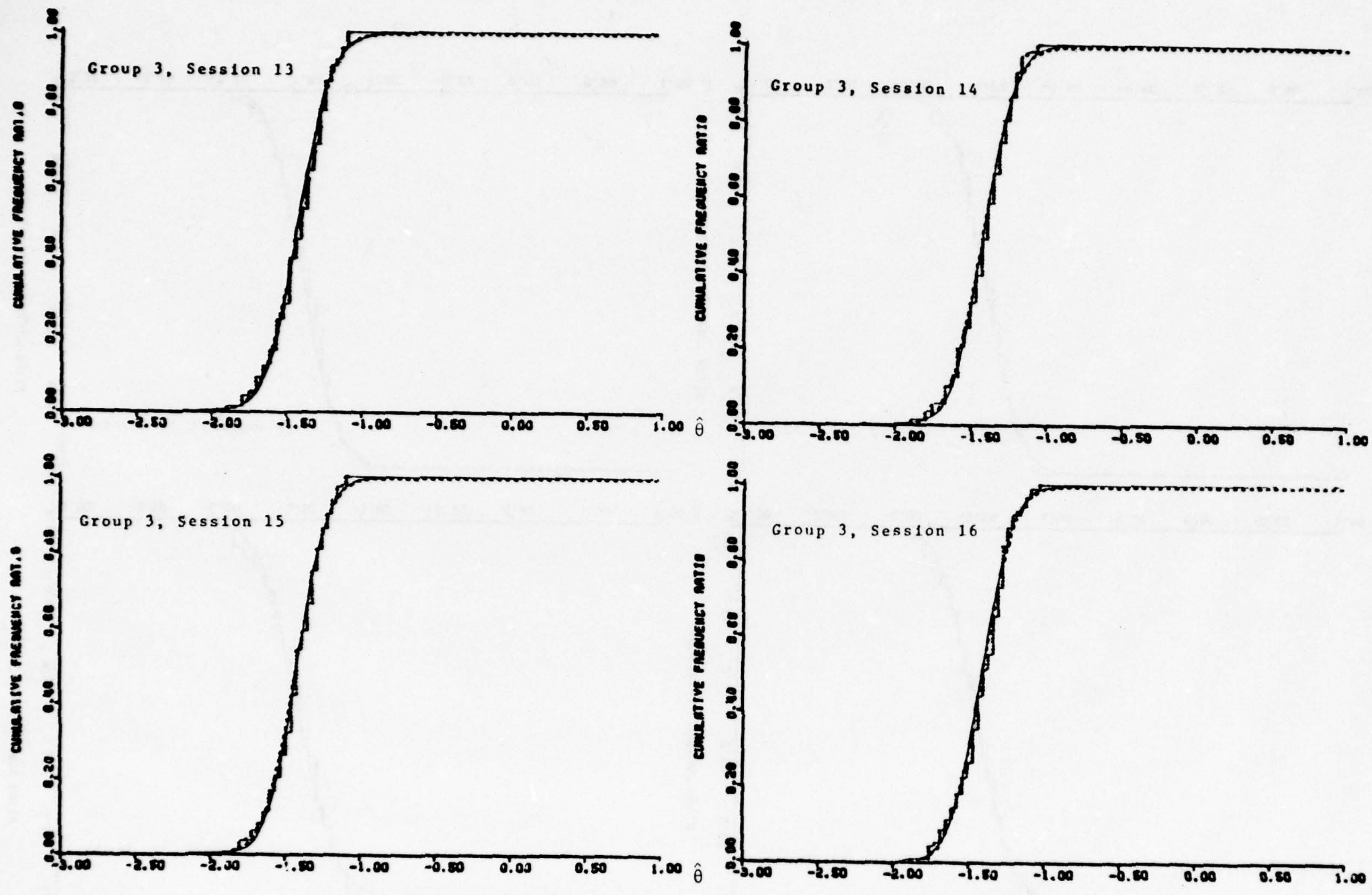

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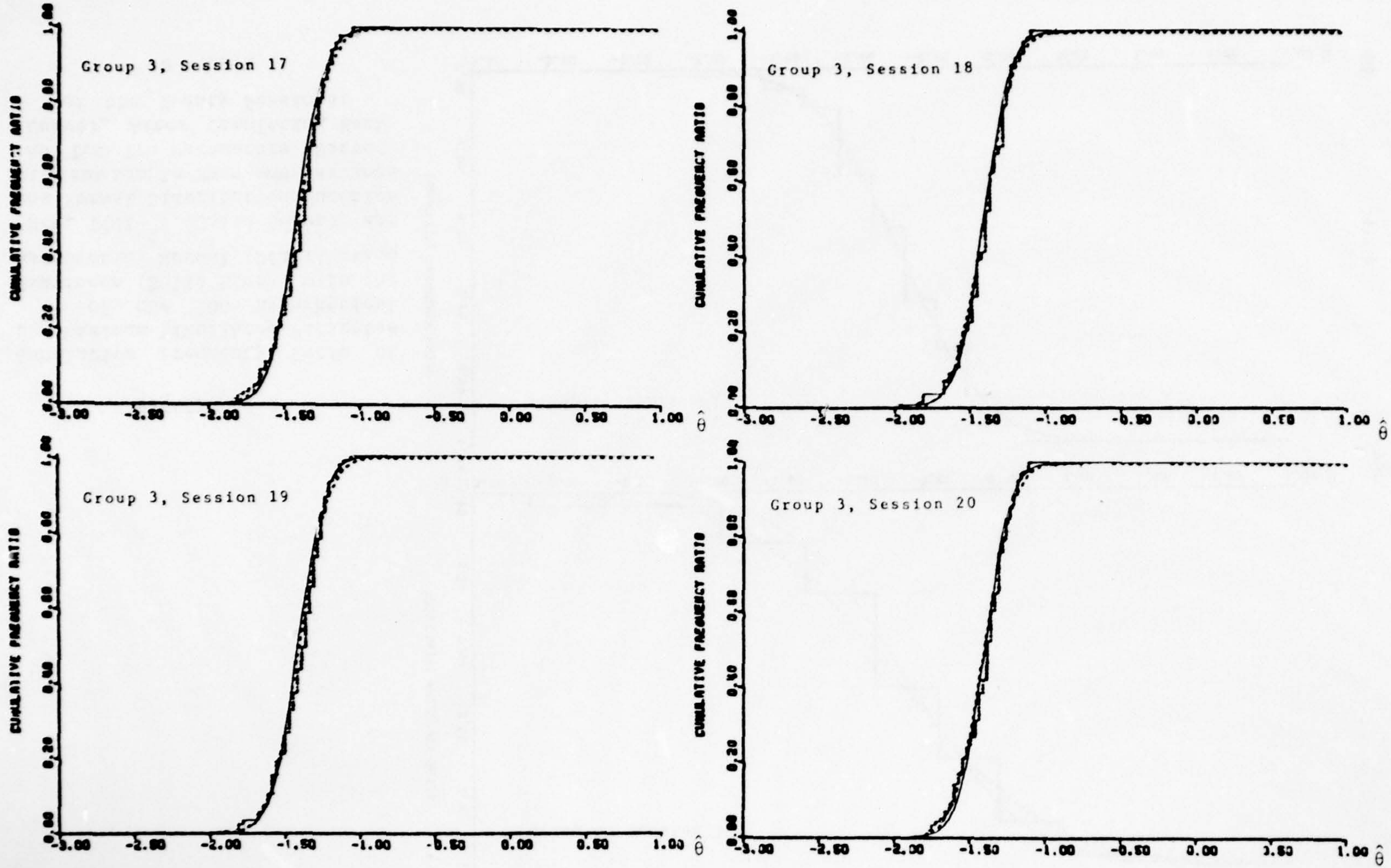

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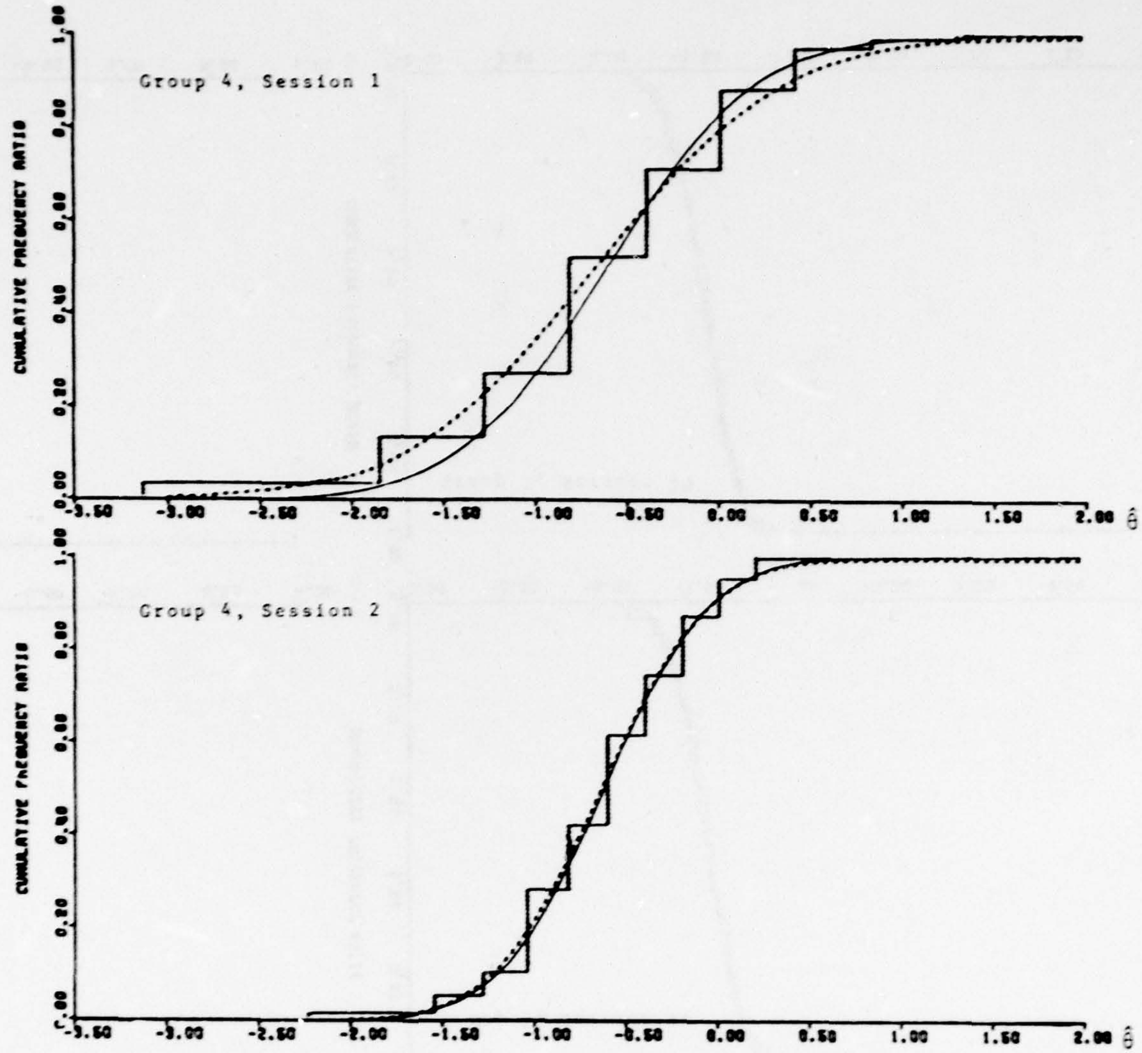

FIGURE A-1-2

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

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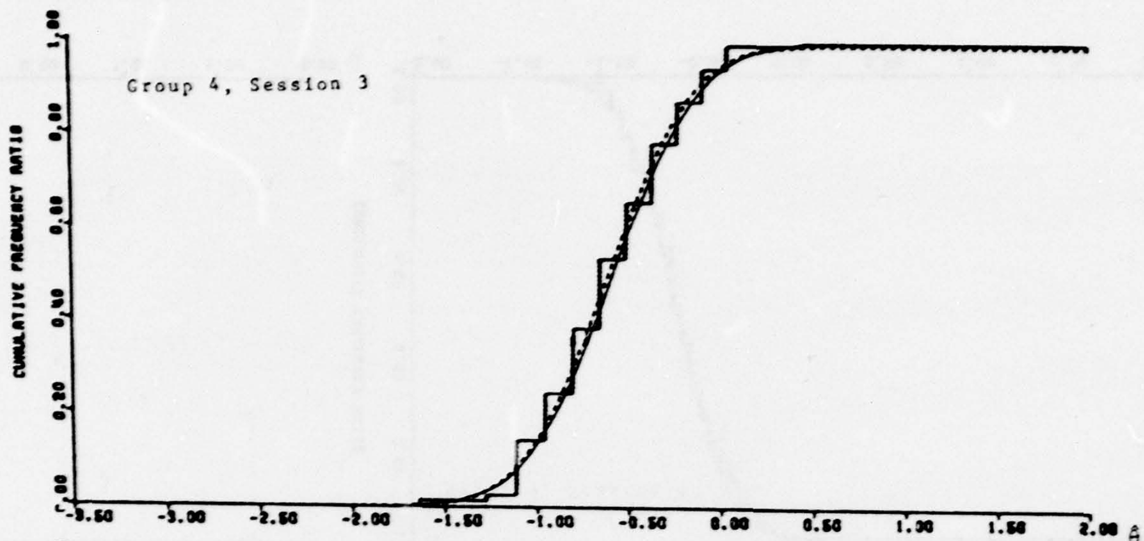

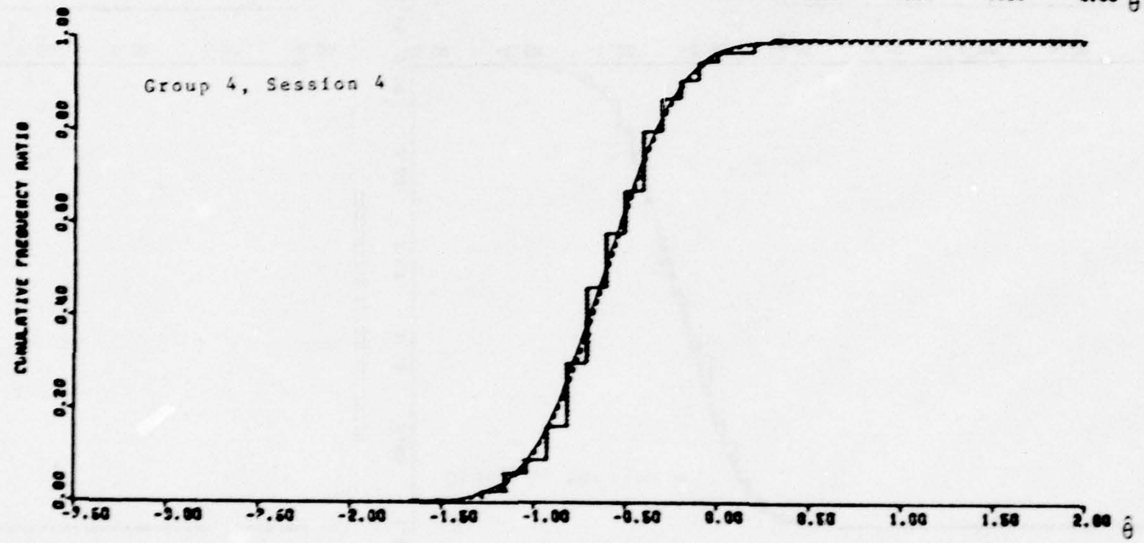

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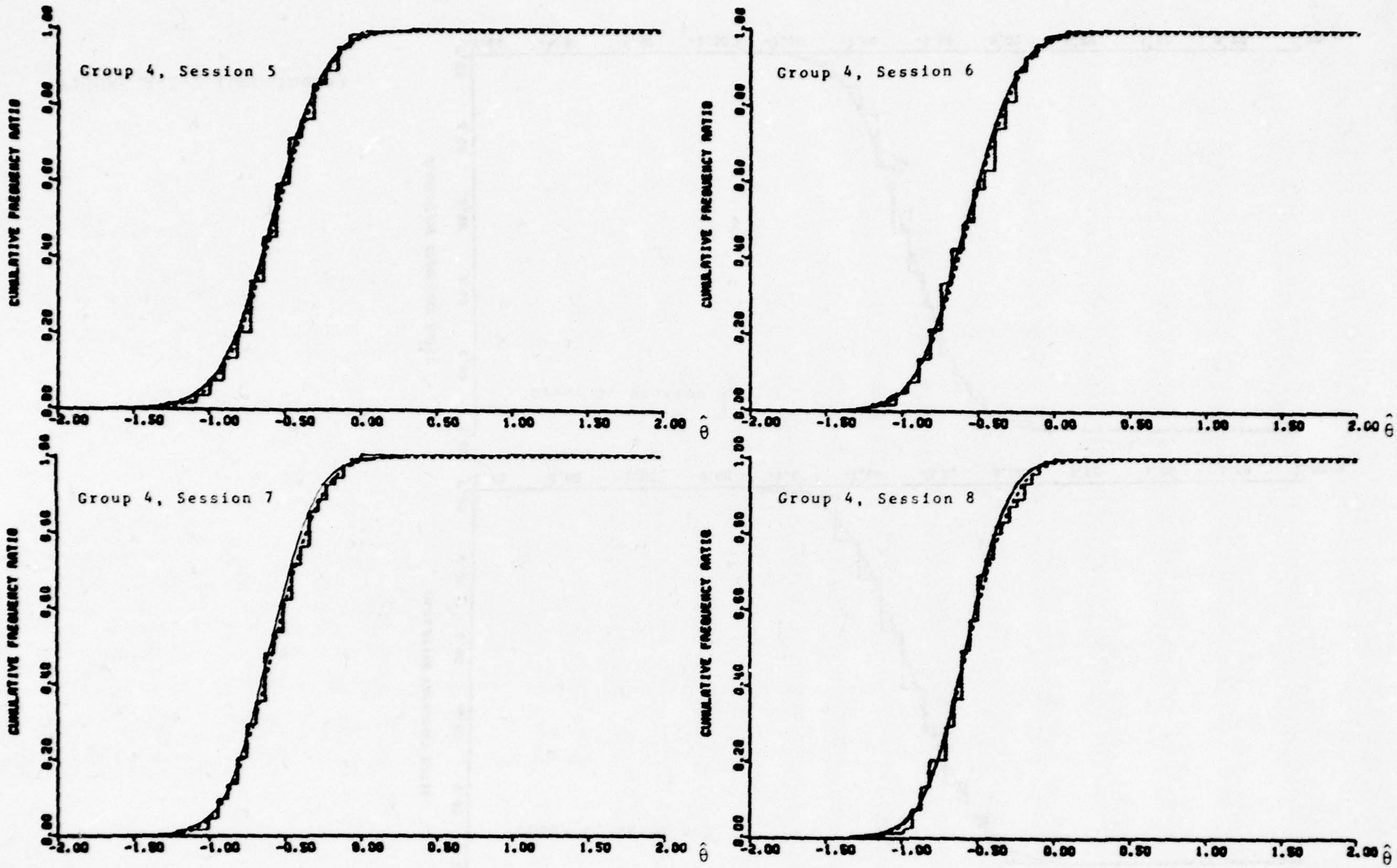

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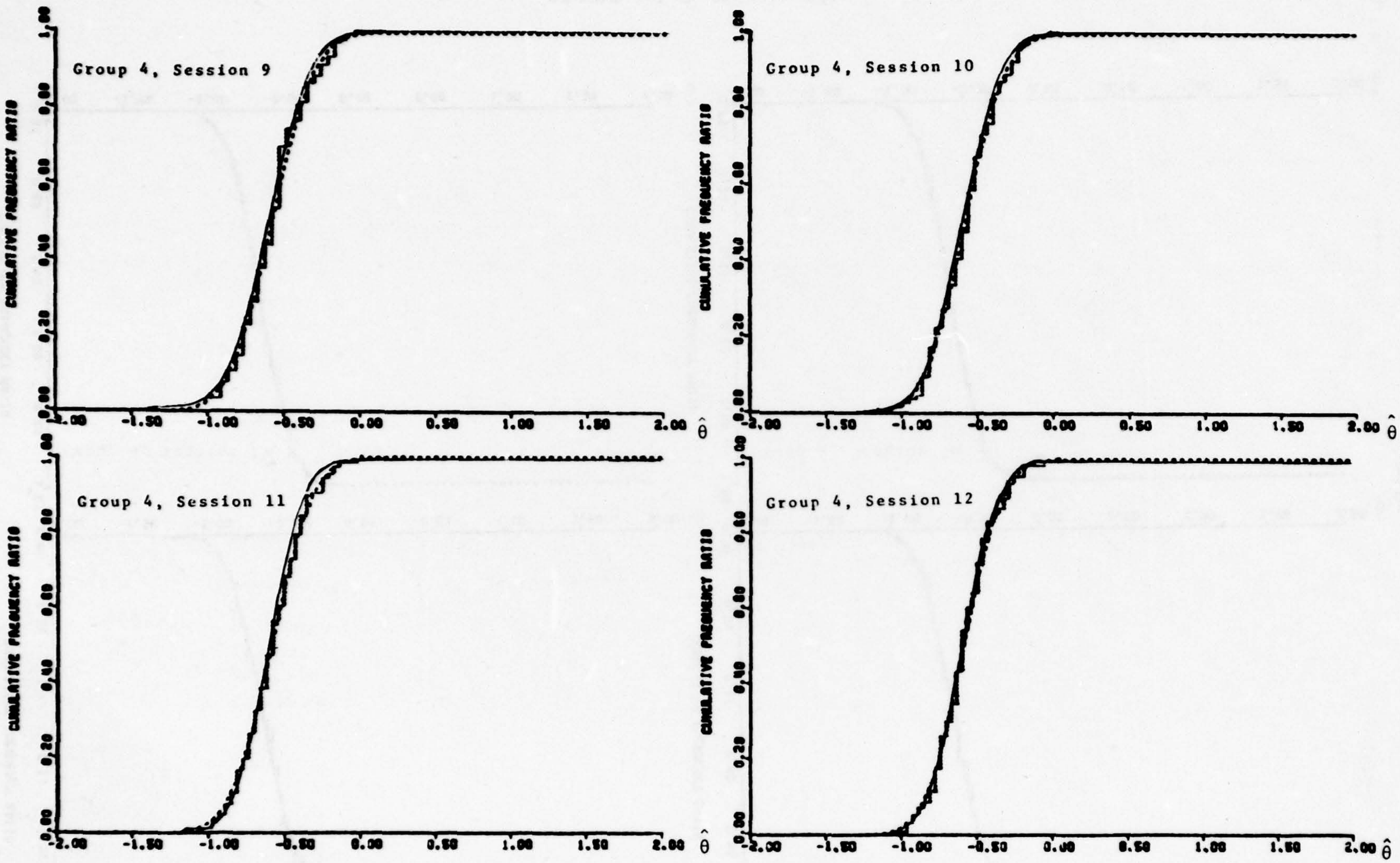

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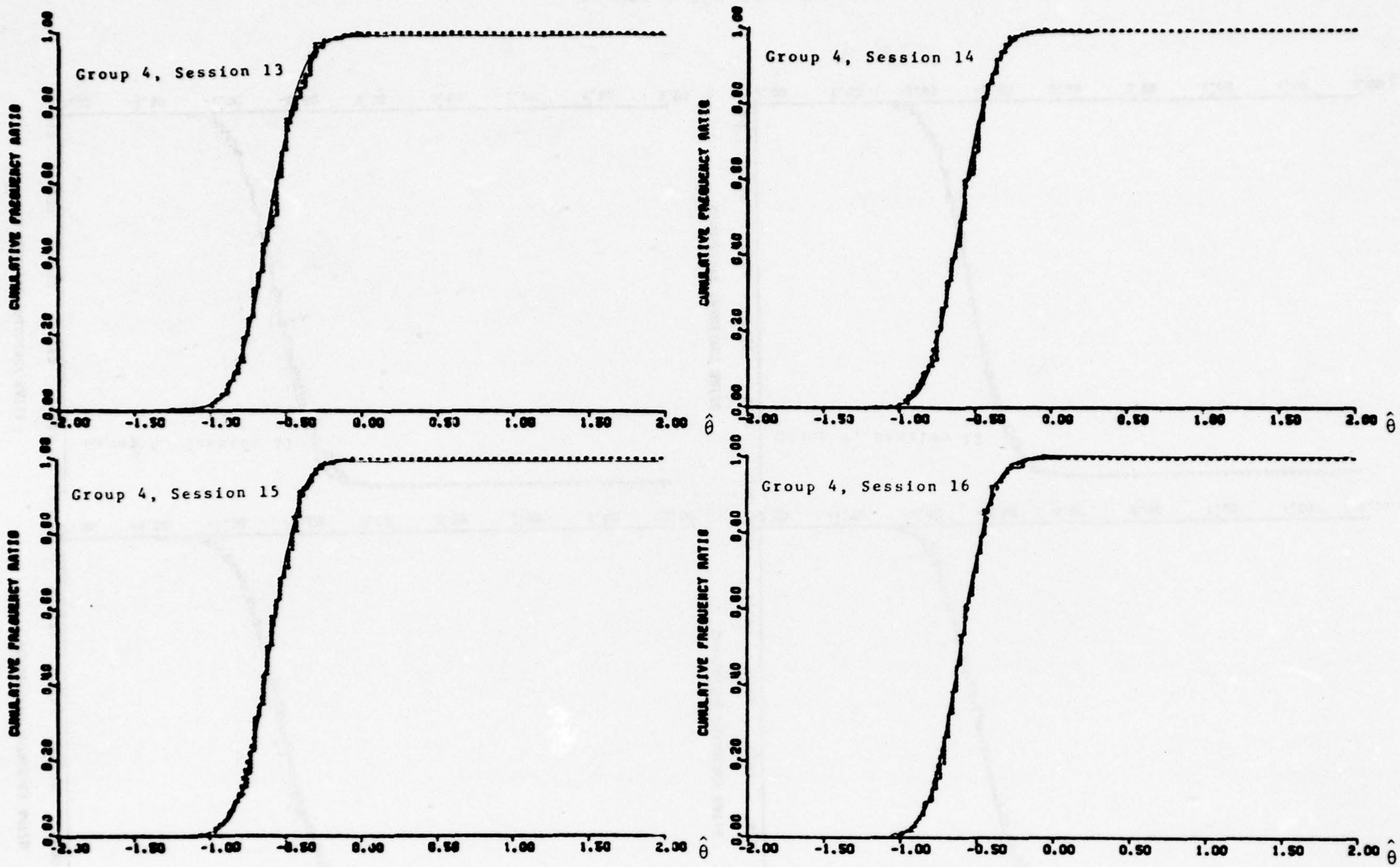

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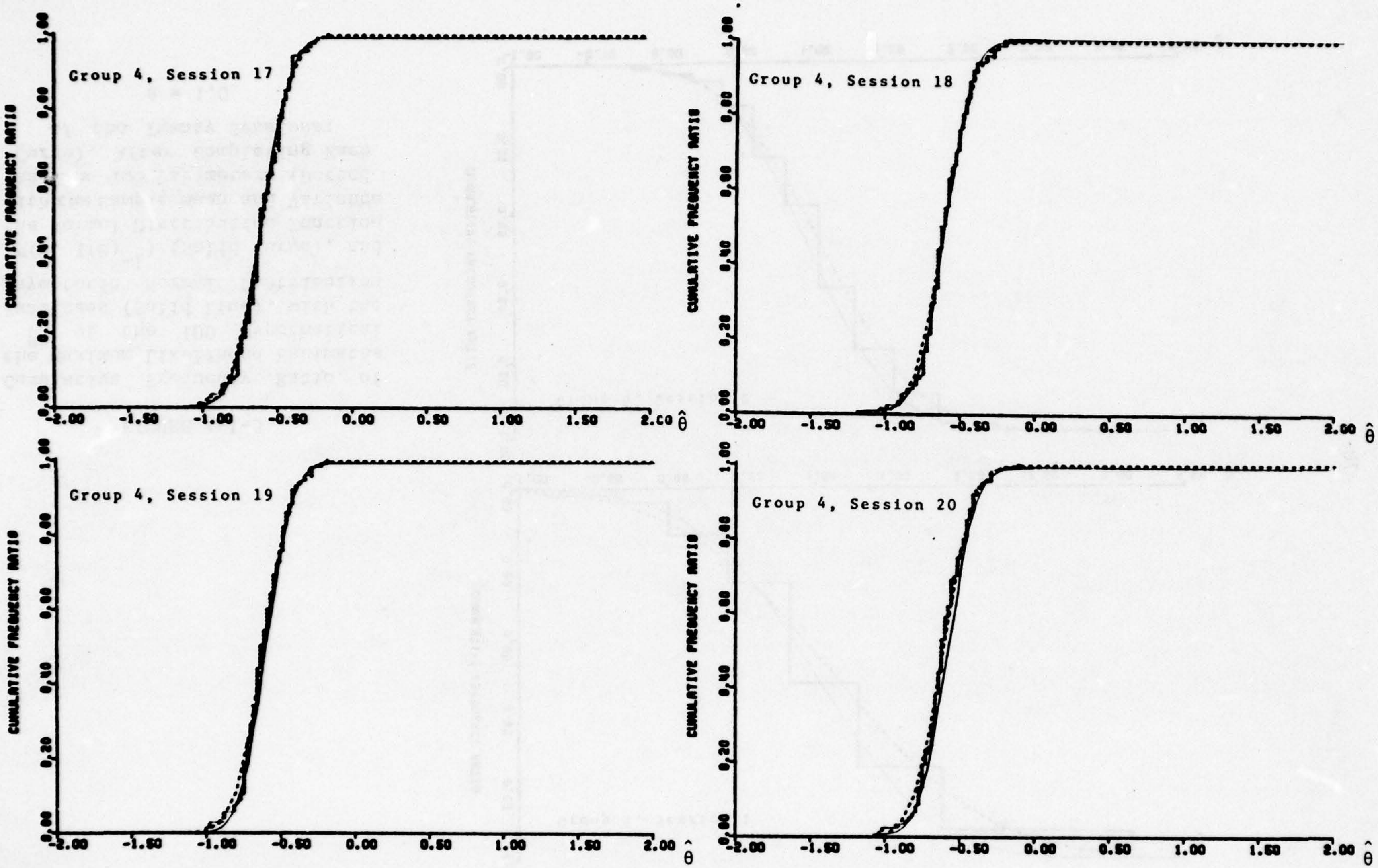

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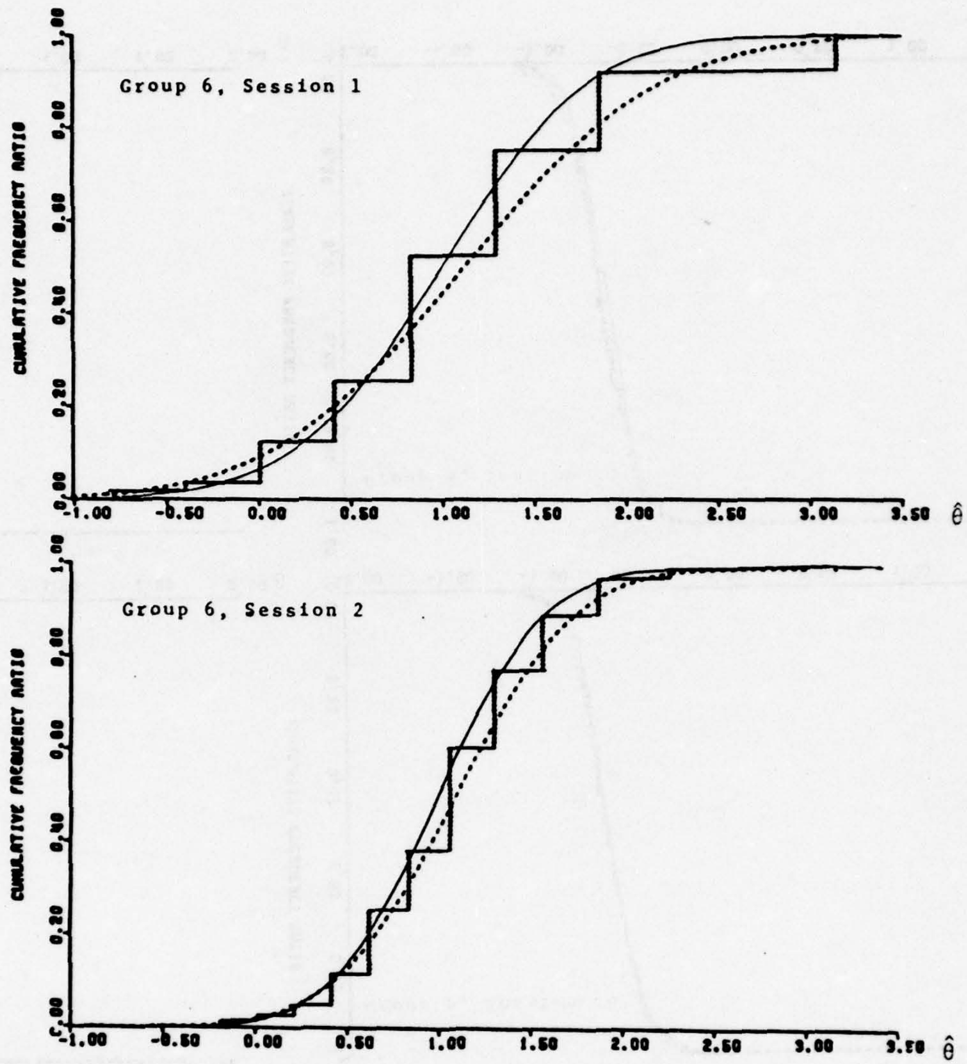


FIGURE A-1-3

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 1.0$

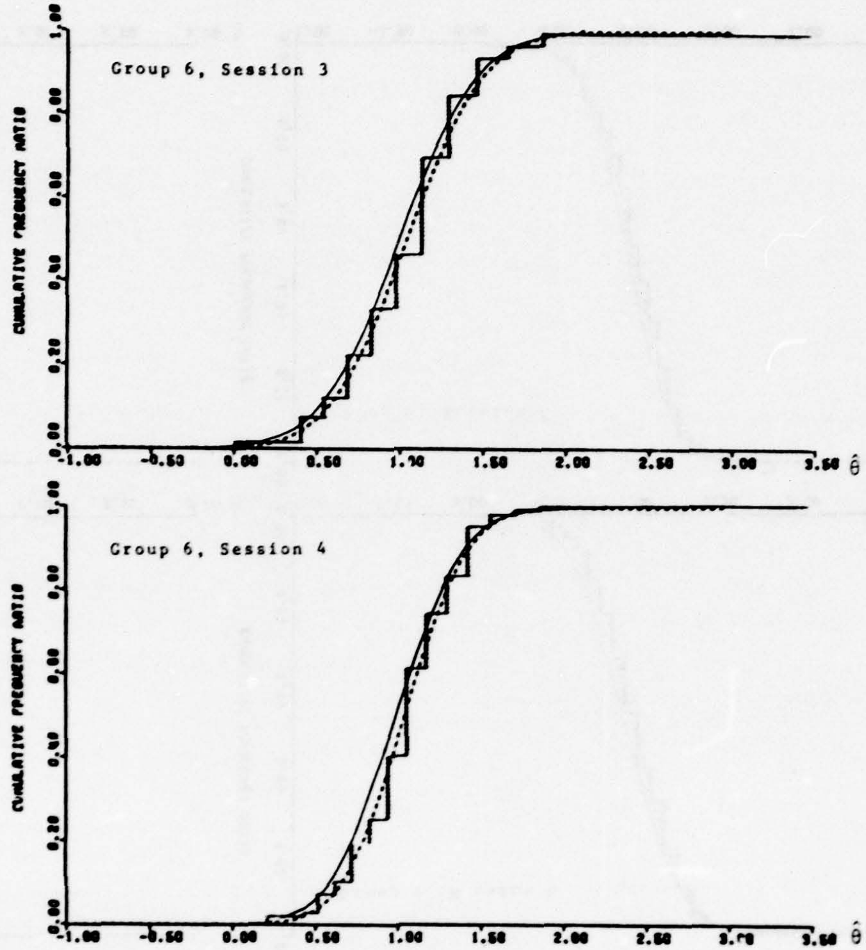


FIGURE A-1-3 (Continued)

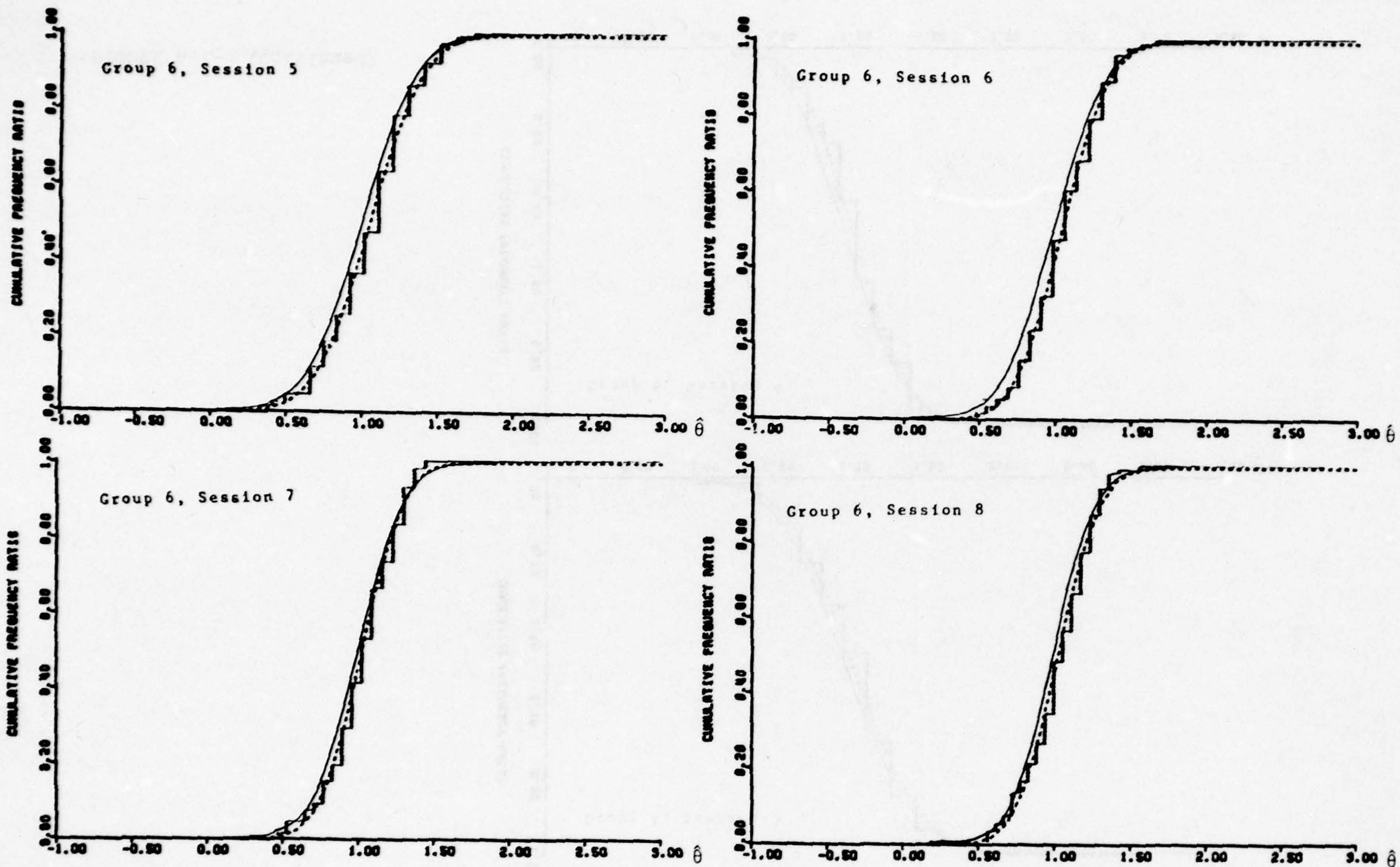
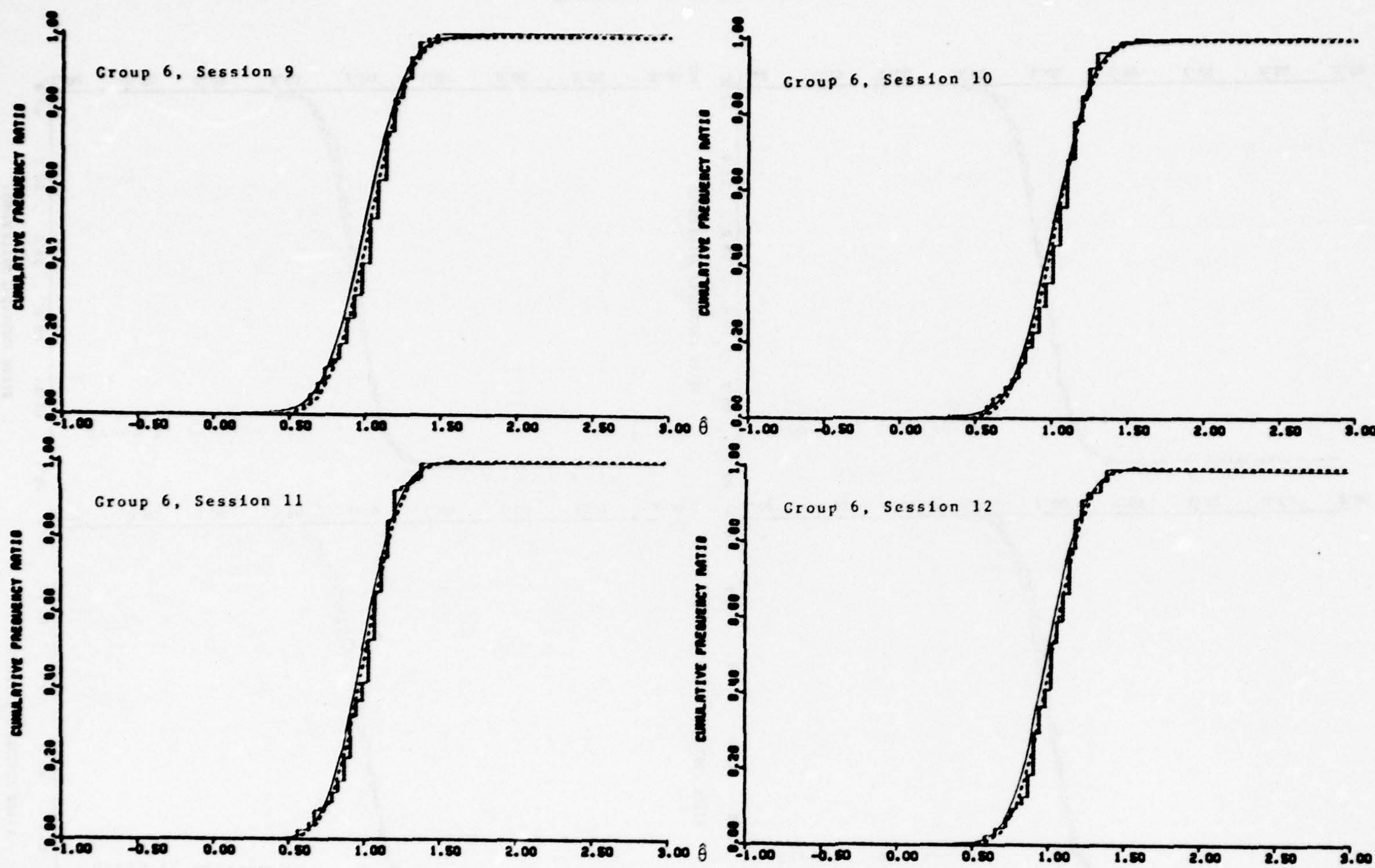


FIGURE A-1-3 (Continued)



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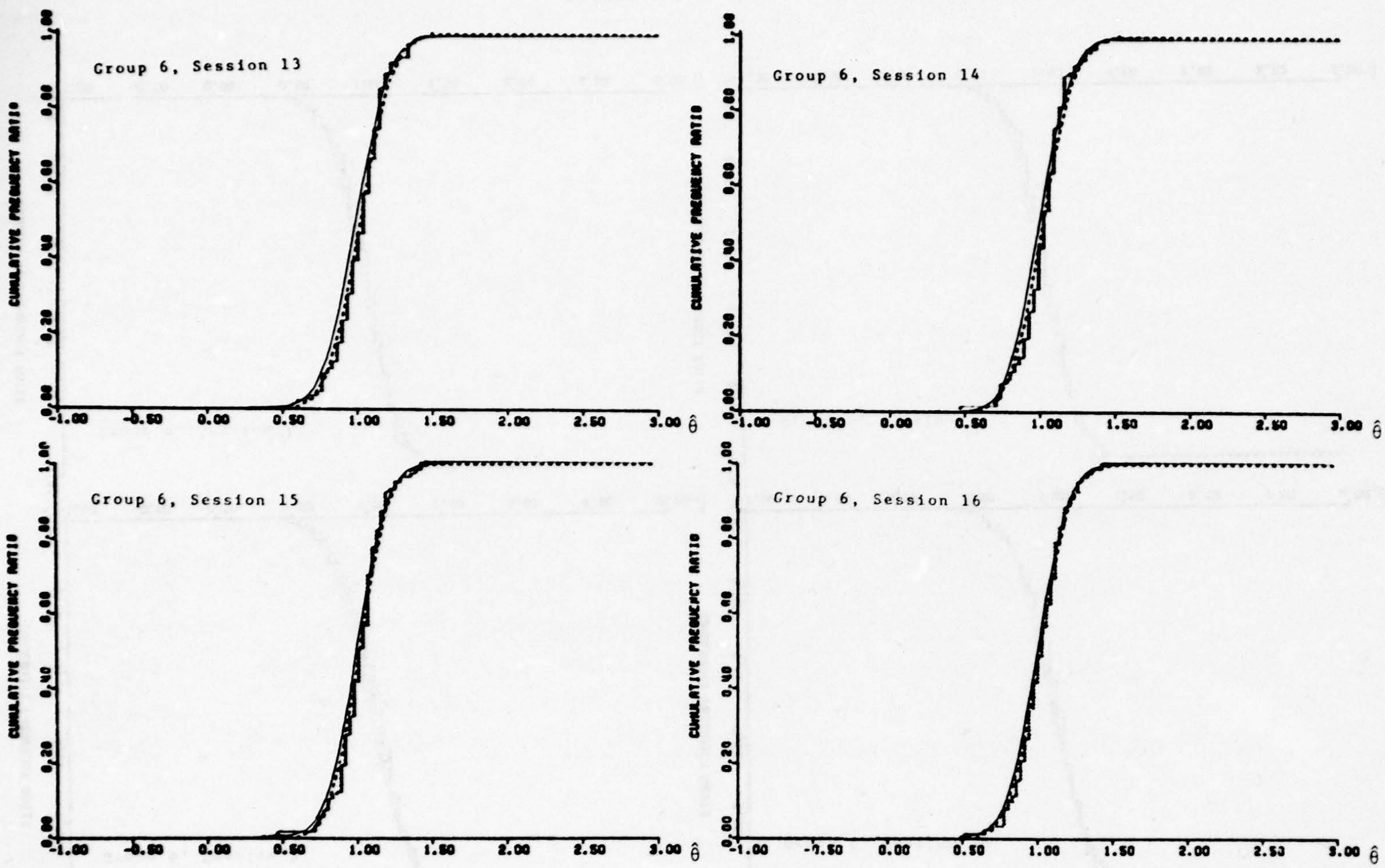

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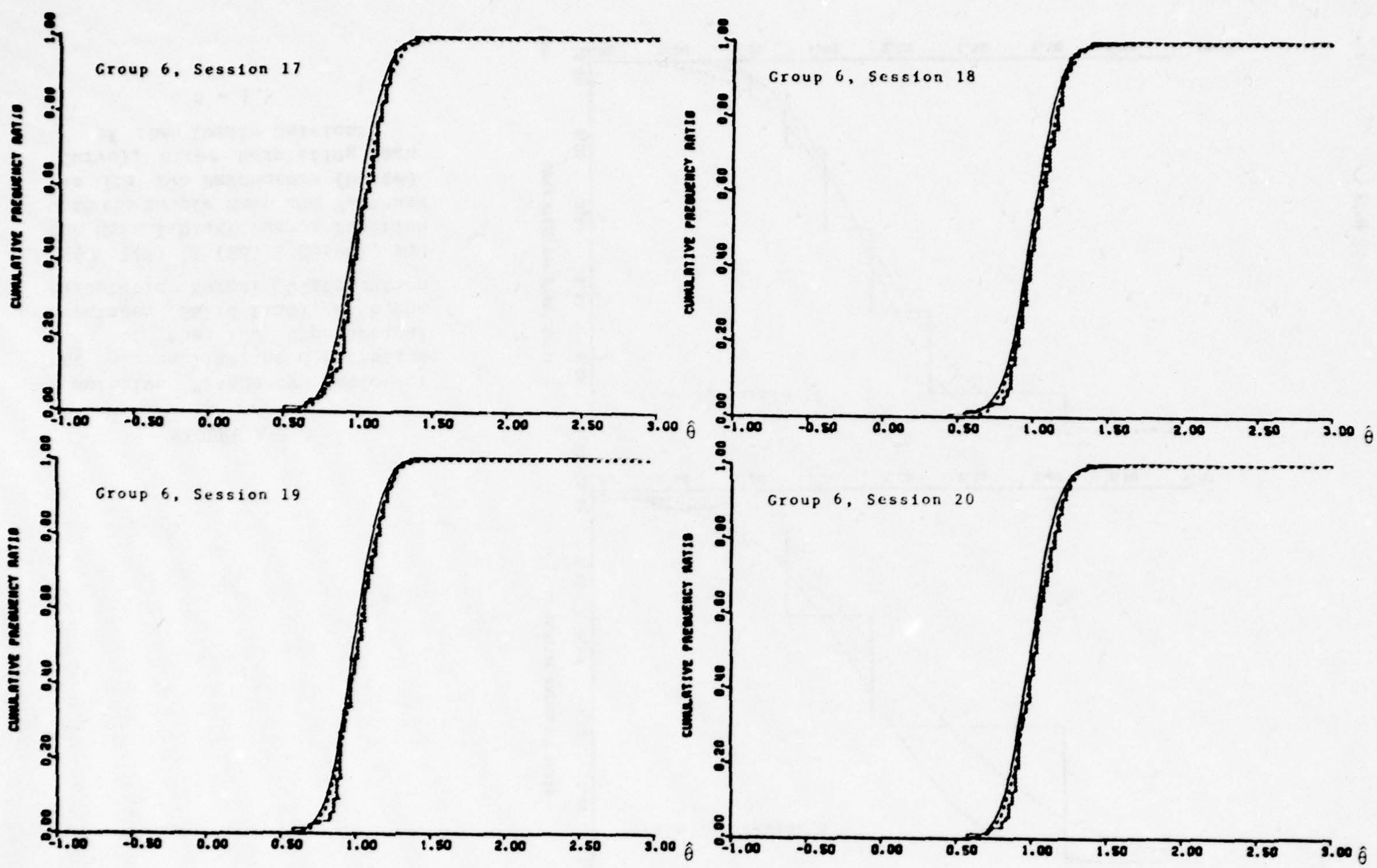

FIGURE A-1-3 (Continued)

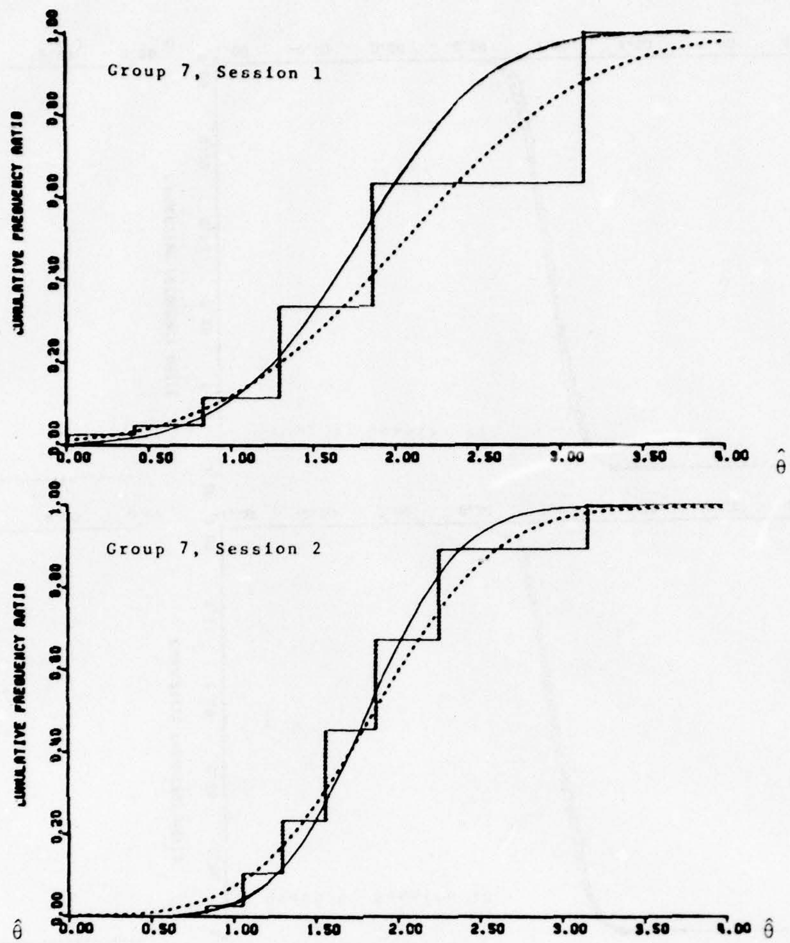

FIGURE A-1-4

Cumulative Frequency Ratio of the Maximum Likelihood Estimates $\hat{\theta}$ of the 100 Hypothetical Examinees (Solid Line), with the Asymptotic Normal Distribution $N(\theta, I(\theta)^{-1})$ (Solid Curve), and the Normal Distribution Function with the Sample Mean and Variance As Its Two Parameters (Dotted Curve), After Completing Each of the Twenty Sessions:

$\theta = 1.8$

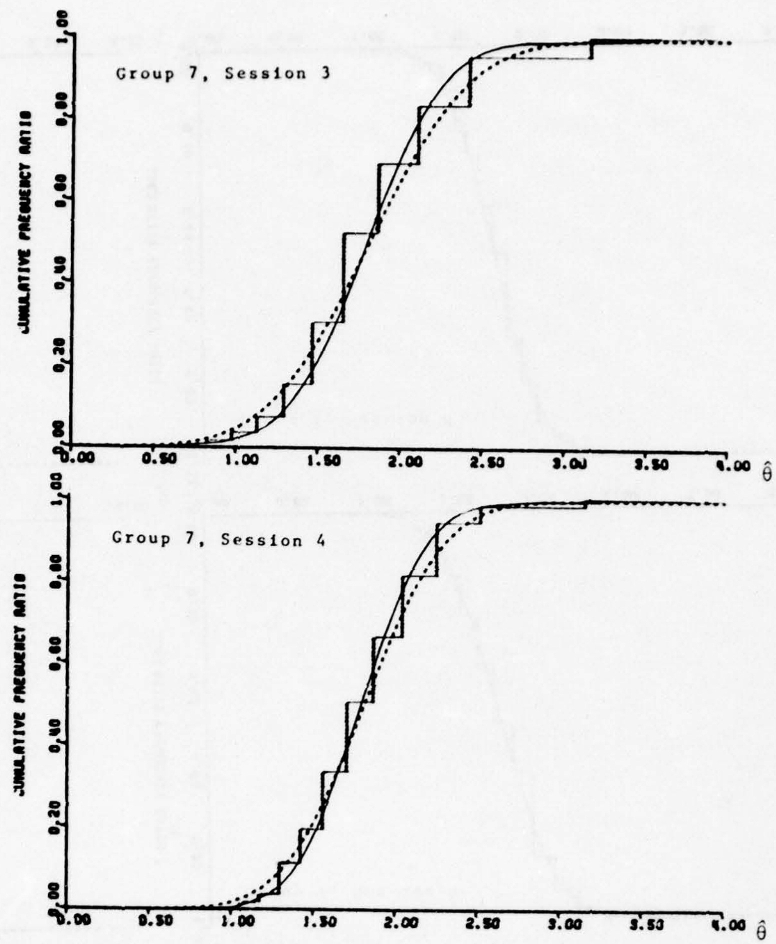

FIGURE A-1-4 (Continued)

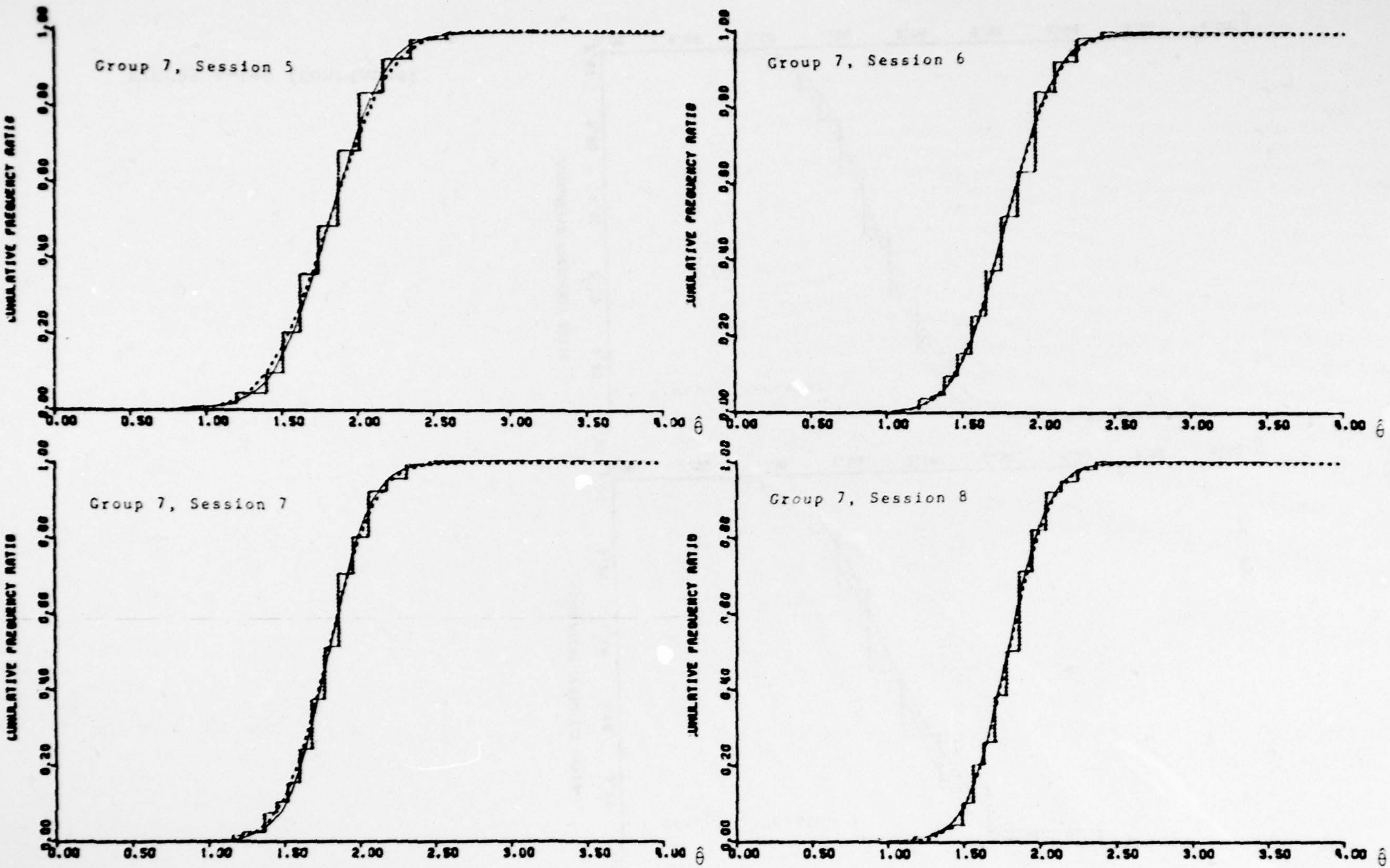

FIGURE A-1-4 (Continued)

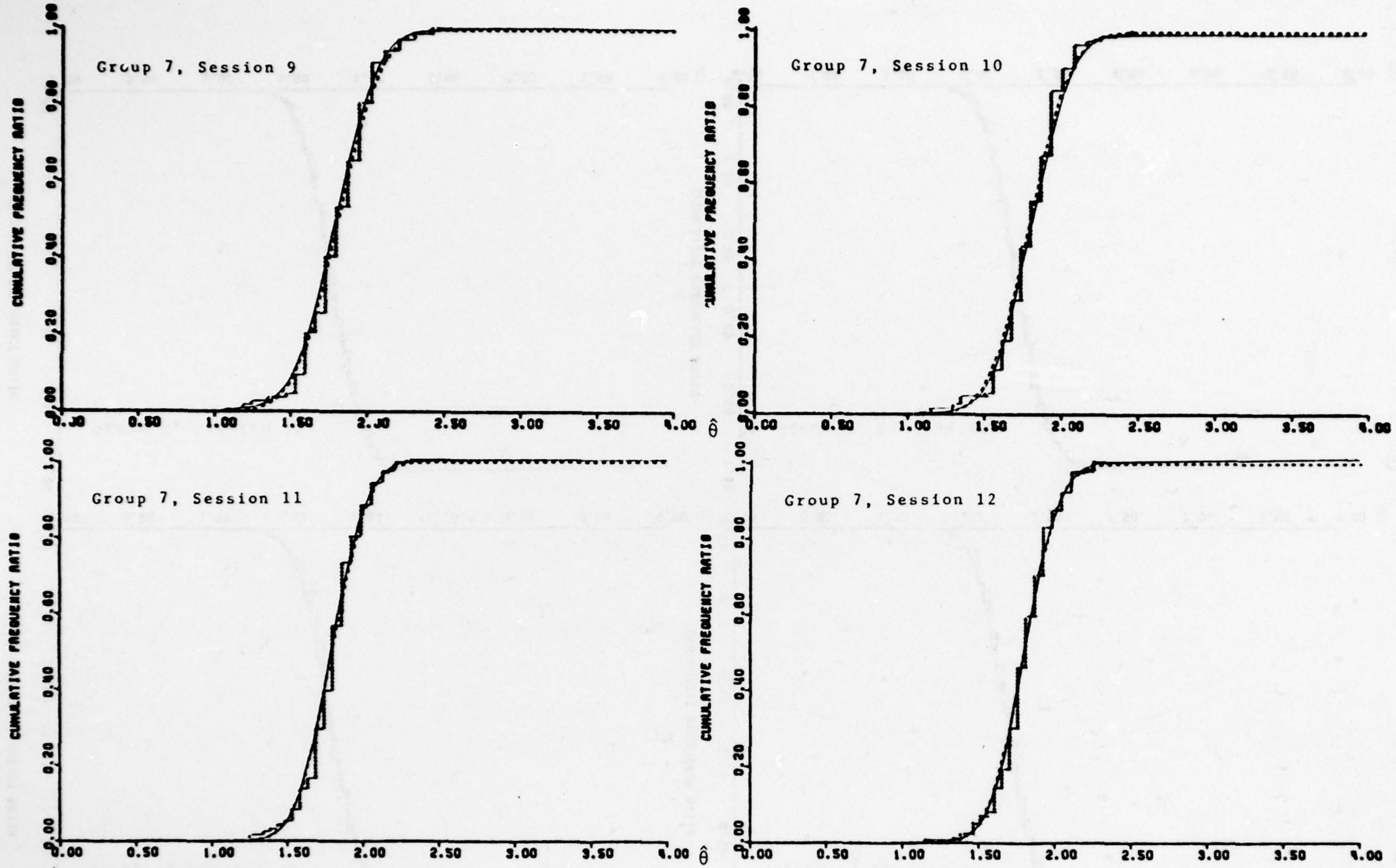

FIGURE A-1-4 (Continued)

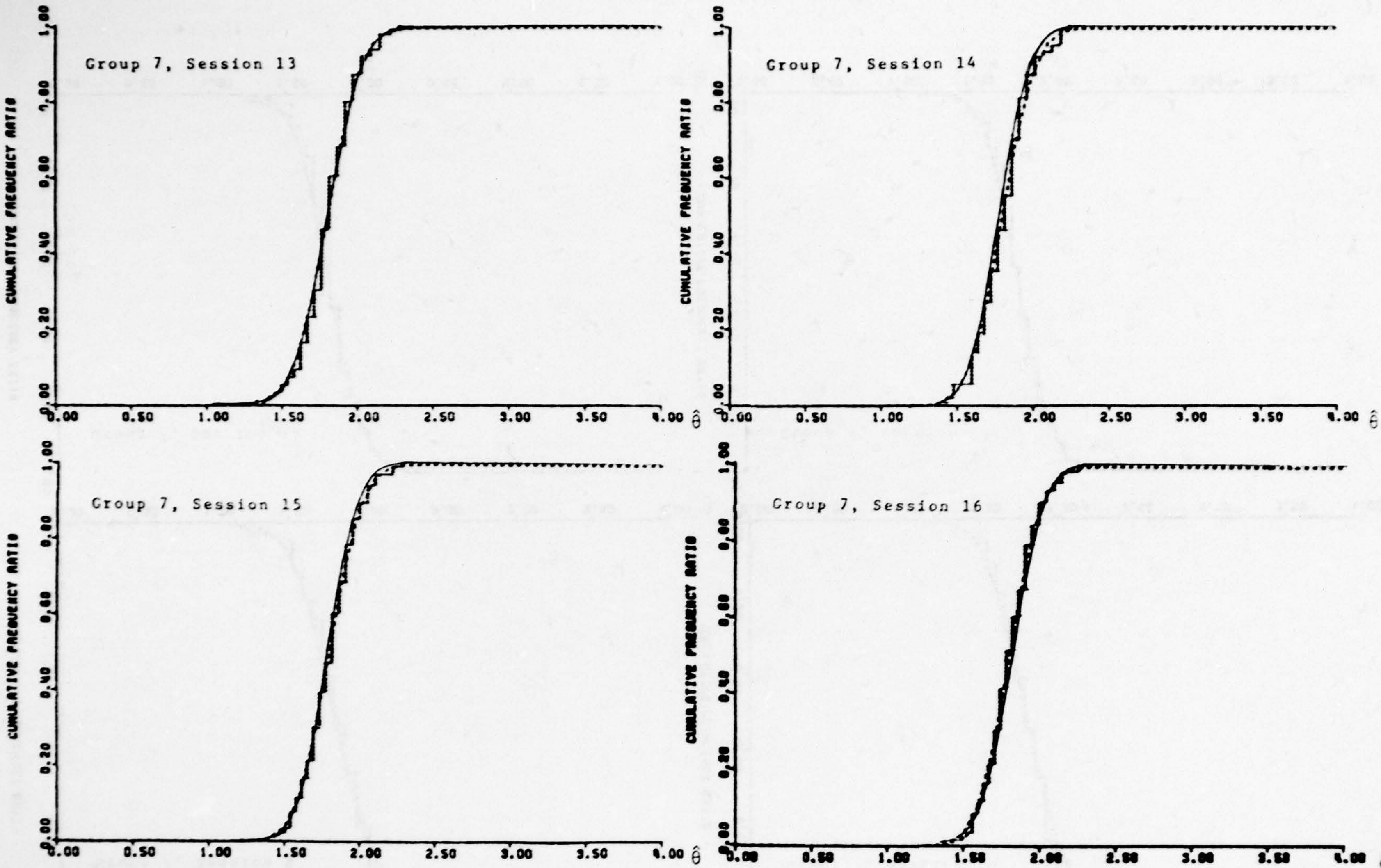

FIGURE A-1-4 (Continued)

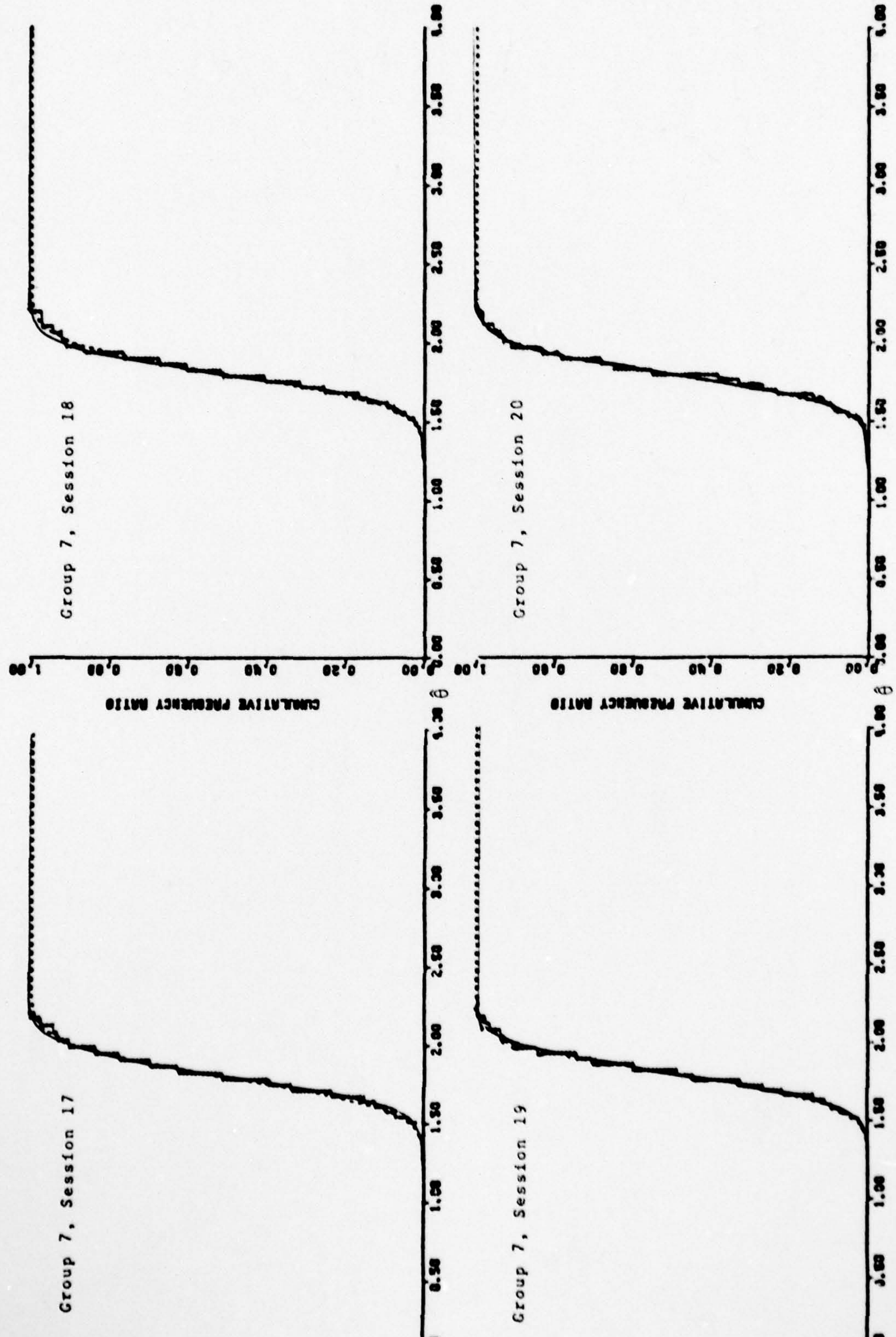

FIGURE A-1-4 (Continued)

APPENDIX II

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TABLE A-2-1

Ten Sample Moments about the Origin of the Maximum Likelihood Estimates of the 100 Hypothetical Examinees after the Completion of Each of the Twenty Sessions. Group 1, $\theta = -3.0$.

Session	Moments about Origin 1	2	3	4	5	6	7	8	9	10
1	-0.3142000D 01	0.9872164D 01	-0.3101834D 02	0.9745962D 02	-0.3062181D 03	0.9621374D 03	-0.3023030D 04	0.9498378D 04	-0.2984390D 05	0.9376954D 05
2	-0.3142000D 01	0.9872164D 01	-0.3101834D 02	0.9745962D 02	-0.3062181D 03	0.9621374D 03	-0.3023030D 04	0.9498378D 04	-0.2984390D 05	0.9376954D 05
3	-0.3142000D 01	0.9872164D 01	-0.3101834D 02	0.9745962D 02	-0.3062181D 03	0.9621374D 03	-0.3023030D 04	0.9498378D 04	-0.2984390D 05	0.9376954D 05
4	-0.3142000D 01	0.9872164D 01	-0.3101834D 02	0.9745962D 02	-0.3062181D 03	0.9621374D 03	-0.3023030D 04	0.9498378D 04	-0.2984390D 05	0.9376954D 05
5	-0.3136320D 01	0.9839697D 01	-0.3087870D 02	0.9692400D 02	-0.3042859D 03	0.9554244D 03	-0.3000291D 04	0.9422664D 04	-0.2959306D 05	0.9295552D 05
6	-0.3116100D 01	0.9722825D 01	-0.3037078D 02	0.9495706D 02	-0.2971272D 03	0.9303517D 03	-0.2914711D 04	0.9135837D 04	-0.2864659D 05	0.8985403D 05
7	-0.3113200D 01	0.9705009D 01	-0.3028905D 02	0.9462494D 02	-0.2958654D 03	0.9257592D 03	-0.2896467D 04	0.9079767D 04	-0.2845601D 05	0.8921546D 05
8	-0.3115060D 01	0.9714969D 01	-0.3032906D 02	0.9476775D 02	-0.2963434D 03	0.9272451D 03	-0.2903285D 04	0.9094450D 04	-0.2850024D 05	0.8934706D 05
9	-0.3116620D 01	0.9723412D 01	-0.3036333D 02	0.9489140D 02	-0.2967616D 03	0.9286533D 03	-0.2907573D 04	0.9107711D 04	-0.2854061D 05	0.8946846D 05
10	-0.3113930D 01	0.9707026D 01	-0.3028859D 02	0.9458870D 02	-0.2956132D 03	0.9244753D 03	-0.2892795D 04	0.9056525D 04	-0.2836017D 05	0.8888135D 05
11	-0.3107620D 01	0.9669253D 01	-0.3011890D 02	0.9391076D 02	-0.2930726D 03	0.9153263D 03	-0.2860785D 04	0.8946575D 04	-0.2799437D 05	0.8763860D 05
12	-0.3105400D 01	0.9655565D 01	-0.3005574D 02	0.9365217D 02	-0.2920816D 03	0.9116367D 03	-0.2847771D 04	0.8901200D 04	-0.2785850D 05	0.8711025D 05
13	-0.3101820D 01	0.9634543D 01	-0.2996292D 02	0.9328699D 02	-0.2907315D 03	0.9068642D 03	-0.2831127D 04	0.8844581D 04	-0.2764855D 05	0.8647972D 05
14	-0.3095520D 01	0.9602462D 01	-0.2981731D 02	0.9269955D 02	-0.2885098D 03	0.8968817D 03	-0.2802647D 04	0.8746067D 04	-0.2731303D 05	0.8535081D 05
15	-0.3088320D 01	0.9553022D 01	-0.2959368D 02	0.9180018D 02	-0.2851177D 03	0.8865306D 03	-0.2759361D 04	0.8596621D 04	-0.2680469D 05	0.8364363D 05
16	-0.3077280D 01	0.9486572D 01	-0.2929357D 02	0.9059482D 02	-0.2805767D 03	0.8700991D 03	-0.2701525D 04	0.8397093D 04	-0.2612852D 05	0.8136714D 05
17	-0.3074970D 01	0.9472639D 01	-0.2923047D 02	0.9034048D 02	-0.2796147D 03	0.8666025D 03	-0.2689156D 04	0.8354213D 04	-0.2598045D 05	0.8087265D 05
18	-0.3072500D 01	0.9457780D 01	-0.2916335D 02	0.9007073D 02	-0.2785973D 03	0.8629155D 03	-0.2676155D 04	0.8309255D 04	-0.2582731D 05	0.8035702D 05
19	-0.3067610D 01	0.9428415D 01	-0.2903088D 02	0.8953872D 02	-0.2765915D 03	0.8556464D 03	-0.2650515D 04	0.8220563D 04	-0.2552502D 05	0.7933856D 05
20	-0.3061140D 01	0.9388898D 01	-0.2884994D 02	0.8880257D 02	-0.2737844D 03	0.8455730D 03	-0.2613905D 04	0.8093193D 04	-0.2506811D 05	0.7789627D 05

Table A-2-1 (Continued): Group 2, θ = -2.2

Session	Moments about Origin 1	2	3	4	5	6	7	8	9	10
1	-0.25873000 01	0.72349260 01	-0.21211150 02	0.65987530 02	-0.19632320 03	0.60834250 03	-0.18959710 04	0.59289280 04	-0.18576910 05	0.58273320 05
2	-0.24401900 01	0.62037590 01	-0.16316540 02	0.46893940 02	-0.13482050 03	0.39693590 03	-0.11698160 04	0.36140970 04	-0.11084430 05	0.34233230 05
3	-0.23410600 01	0.56996520 01	-0.14414300 02	0.37807250 02	-0.10255140 03	0.28635720 03	-0.81999650 03	0.23969650 04	-0.71236720 04	0.21449530 05
4	-0.23016200 01	0.54629940 01	-0.13301260 02	0.33862210 02	-0.88211030 02	0.23686650 03	-0.65341480 03	0.18461870 04	-0.53251600 04	0.15628820 05
5	-0.22642400 01	0.52152630 01	-0.12225600 02	0.29168840 02	-0.71027280 02	0.17630230 03	-0.44665520 03	0.11558470 04	-0.30546250 04	0.82423720 04
6	-0.22641500 01	0.51977590 01	-0.12109860 02	0.28608690 02	-0.68570500 02	0.16680820 03	-0.41204160 03	0.10340360 04	-0.26377030 04	0.68423050 04
7	-0.22407100 01	0.50716840 01	-0.11593050 02	0.26749250 02	-0.62279770 02	0.14626450 03	-0.34635580 03	0.82667270 03	-0.19879680 04	0.48149160 04
8	-0.22329200 01	0.50507020 01	-0.11435410 02	0.26225520 02	-0.60676700 02	0.14161590 03	-0.33338830 03	0.79155190 03	-0.18950750 04	0.45740650 04
9	-0.22265900 01	0.50034570 01	-0.11347900 02	0.25978110 02	-0.60025130 02	0.14001780 03	-0.32965360 03	0.78334240 03	-0.18784810 04	0.45450740 04
10	-0.22321000 01	0.50232820 01	-0.11430850 02	0.26223070 02	-0.60708640 02	0.14181730 03	-0.33427340 03	0.79493230 03	-0.19070610 04	0.46146790 04
11	-0.22196000 01	0.49667970 01	-0.11204550 02	0.25460970 02	-0.58415230 02	0.13499170 03	-0.31443990 03	0.73822950 03	-0.17467710 04	0.41651660 04
12	-0.22110200 01	0.49255770 01	-0.11038500 02	0.24922110 02	-0.56653300 02	0.12965480 03	-0.29805330 03	0.69259420 03	-0.16161620 04	0.37946600 04
13	-0.22177600 01	0.49538730 01	-0.11124720 02	0.25160470 02	-0.57273070 02	0.13120730 03	-0.30249450 03	0.70176010 03	-0.16380700 04	0.38468170 04
14	-0.22116800 01	0.49208460 01	-0.11014090 02	0.24799420 02	-0.56170370 02	0.12797660 03	-0.29328600 03	0.67602840 03	-0.15671890 04	0.36536380 04
15	-0.22093500 01	0.49038830 01	-0.10966240 02	0.24654850 02	-0.55643610 02	0.12636720 03	-0.28852680 03	0.66228740 03	-0.15282280 04	0.35447000 04
16	-0.21978500 01	0.48575550 01	-0.10793550 02	0.24115260 02	-0.54170560 02	0.12234070 03	-0.27777050 03	0.63399990 03	-0.14546360 04	0.33546800 04
17	-0.21967100 01	0.48506950 01	-0.10766590 02	0.24020420 02	-0.53863730 02	0.12139790 03	-0.27498660 03	0.62601230 03	-0.14322250 04	0.32929220 04
18	-0.21909700 01	0.48235140 01	-0.10670330 02	0.23717840 02	-0.52972630 02	0.11887830 03	-0.26805510 03	0.60731090 03	-0.13824780 04	0.31619800 04
19	-0.21916400 01	0.48254020 01	-0.10673520 02	0.23719550 02	-0.52959330 02	0.11880330 03	-0.26777840 03	0.60644800 03	-0.13800380 04	0.31555460 04
20	-0.21936300 01	0.48319200 01	-0.10687550 02	0.23736060 02	-0.52945230 02	0.11858400 03	-0.26671390 03	0.60240000 03	-0.13662900 04	0.31118270 04

Table A-2-1 (Continued): Group 3, θ = -1.4

Session	1	2	3	4	5	6	7	8	9	10
	Moments about Origin									
1	-0.14534930D 01	0.27680330D 01	-0.63434080D 01	0.16483150D 02	-0.46344390D 02	[illegible] 03	[illegible] 03	0.12719220D 04	[illegible] 04	0.12314050D 05
2	-0.14279300D 01	0.22795300D 01	-0.39741130D 01	0.74990800D 01	-0.15246530D 02	0.53275620D 02	-0.77592780D 02	0.19218290D 03	-0.50178110D 03	0.13594730D 04
3	-0.14508700D 01	0.22772830D 01	-0.38553420D 01	0.70367870D 01	-0.13868910D 02	0.29569740D 02	-0.68152090D 02	0.16889830D 03	-0.44564110D 03	0.12363900D 04
4	-0.14447500D 01	0.21960960D 01	-0.35026360D 01	0.58553650D 01	-0.10249990D 02	0.18759200D 02	-0.35602320D 02	0.71001880D 02	-0.14569540D 03	0.30794900D 03
5	-0.14398400D 01	0.21545270D 01	-0.33492060D 01	0.54060970D 01	-0.90540840D 01	0.15715750D 02	-0.26203930D 02	0.52263170D 02	-0.99648870D 02	0.19495970D 03
6	-0.14142400D 01	0.20682250D 01	-0.31270900D 01	0.48864670D 01	-0.78867920D 01	0.13155920D 02	-0.22549000D 02	0.39629310D 02	-0.72253510D 02	0.13432970D 03
7	-0.14124300D 01	0.20489320D 01	-0.30524200D 01	0.46707450D 01	-0.73418840D 01	0.11855170D 02	-0.19559350D 02	0.33455530D 02	-0.58407220D 02	0.10439760D 03
8	-0.14155300D 01	0.20542400D 01	-0.30555660D 01	0.46590740D 01	-0.72760910D 01	0.11651150D 02	-0.19011640D 02	0.31735400D 02	-0.54010600D 02	0.93596270D 02
9	-0.14158800D 01	0.20539540D 01	-0.30517600D 01	0.46409160D 01	-0.72161260D 01	0.11457400D 02	-0.18546010D 02	0.30565640D 02	-0.51188290D 02	0.86974720D 02
10	-0.14152400D 01	0.20493550D 01	-0.30352610D 01	0.45951810D 01	-0.71052410D 01	0.11205380D 02	[illegible] 02	0.29489840D 02	-0.49047210D 02	0.82000810D 02
11	-0.14105500D 01	0.20302730D 01	-0.29815250D 01	0.44655770D 01	-0.68173140D 01	0.10690020D 02	-0.16773830D 02	0.28971750D 02	-0.44044080D 02	0.72950250D 02
12	-0.14186800D 01	0.20489670D 01	-0.30115880D 01	0.45023670D 01	-0.68420460D 01	0.10560820D 02	-0.16542700D 02	0.26273530D 02	-0.42209490D 02	0.68821210D 02
13	-0.14187600D 01	0.20446040D 01	-0.29928930D 01	0.44492820D 01	-0.67156500D 01	0.10287710D 02	-0.15981170D 02	0.25188320D 02	-0.40205130D 02	0.64990560D 02
14	-0.14216800D 01	0.20496460D 01	-0.29955950D 01	0.44389360D 01	-0.66686290D 01	0.10155260D 02	-0.15672810D 02	0.24505920D 02	-0.38606320D 02	0.62206870D 02
15	-0.14194800D 01	0.20424200D 01	-0.29788540D 01	0.44036500D 01	-0.65974190D 01	0.10014710D 02	-0.15393460D 02	0.23973540D 02	-0.37775530D 02	0.60213690D 02
16	-0.14135000D 01	0.20244890D 01	-0.29378160D 01	0.43187400D 01	-0.64300180D 01	0.96920610D 01	-0.14767730D 02	0.22821860D 02	-0.35009150D 02	0.56139480D 02
17	-0.14073400D 01	0.20060830D 01	-0.28966030D 01	0.42367570D 01	-0.62771890D 01	0.94195420D 01	-0.14515100D 02	0.22016260D 02	-0.34267370D 02	0.53945640D 02
18	-0.14040600D 01	0.19959820D 01	-0.28734410D 01	0.41898360D 01	-0.61886390D 01	0.92603390D 01	-0.14057000D 02	0.21555600D 02	-0.33524160D 02	0.52743010D 02
19	-0.14001800D 01	0.19850890D 01	-0.28500430D 01	0.41441650D 01	-0.61030340D 01	0.91023550D 01	-0.13746030D 02	0.21010140D 02	-0.32523740D 02	0.50910270D 02
20	-0.14012930D 01	0.19870880D 01	-0.28516700D 01	0.41427650D 01	-0.60909020D 01	0.90625950D 01	-0.13641730D 02	0.20769010D 02	-0.31966740D 02	0.49716830D 02

Table A-2-1 (Continued): Group 4, θ = -0.6

Session	Moments about Origin 1	2	3	4	5
1	-0.67666000D 00	0.11170760D 01	-0.19807440D 01	0.46506420D 01	-0.11929910D 02
2	-0.63657000D 00	0.62014270D 00	-0.70492170D 00	0.93079940D 00	-0.13961690D 01
3	-0.62515000D 00	0.51938550D 00	-0.48215620D 00	0.49262740D 00	-0.54027290D 00
4	-0.59573000D 00	0.45660880D 00	-0.38291390D 00	0.35046410D 00	-0.34126210D 00
5	-0.56618000D 00	0.39512700D 00	-0.30324190D 00	0.25335940D 00	-0.22556760D 00
6	-0.55942000D 00	0.38437500D 00	-0.29322650D 00	0.24059610D 00	-0.20839520D 00
7	-0.57095000D 00	0.38890380D 00	-0.29266690D 00	0.23656660D 00	-0.20224490D 00
8	-0.56255000D 00	0.37165630D 00	-0.26921480D 00	0.20869440D 00	-0.17089460D 00
9	-0.57704000D 00	0.37998370D 00	-0.27125980D 00	0.20579520D 00	-0.16402040D 00
10	-0.57993000D 00	0.37835600D 00	-0.26697470D 00	0.19995570D 00	-0.15714820D 00
11	-0.58333000D 00	0.38553290D 00	-0.27555970D 00	0.20958780D 00	-0.16801440D 00
12	-0.58671000D 00	0.38353950D 00	-0.26778350D 00	0.19678410D 00	-0.15074710D 00
13	-0.59812000D 00	0.39303940D 00	-0.27567100D 00	0.20350560D 00	-0.15658170D 00
14	-0.59408000D 00	0.38298450D 00	-0.26215770D 00	0.18848040D 00	-0.14107890D 00
15	-0.59590000D 00	0.38462120D 00	-0.26310330D 00	0.18872300D 00	-0.14090840D 00
16	-0.59779000D 00	0.38427140D 00	-0.26076980D 00	0.18510870D 00	-0.13661270D 00
17	-0.59896000D 00	0.38337870D 00	-0.25912890D 00	0.18370970D 00	-0.13603830D 00
18	-0.60791000D 00	0.39285520D 00	-0.26705310D 00	0.18983700D 00	-0.14071260D 00
19	-0.61208000D 00	0.39805490D 00	-0.27161210D 00	0.19310680D 00	-0.14246120D 00
20	-0.61146000D 00	0.39795350D 00	-0.27214360D 00	0.19437180D 00	-0.14459300D 00

Session	6	7	8	9	10
1	0.53705270D 02	-0.59055330D 02	0.30015750D 03	-0.92262360D 03	0.28652390D 04
2	0.23551610D 01	-0.42759460D 01	0.85474330D 01	-0.17058770D 02	0.35955900D 02
3	0.63334610D 00	-0.78801060D 00	0.10262920D 01	-0.14362900D 01	0.20720760D 01
4	0.34995590D 00	-0.37406390D 00	0.41327150D 00	-0.46670790D 00	0.54251860D 00
5	0.21250320D 00	-0.21020010D 00	0.21694340D 00	-0.25210190D 00	0.25616400D 00
6	0.18355900D 00	-0.17704410D 00	0.17168470D 00	-0.17129700D 00	0.17527300D 00
7	0.16112050D 00	-0.16001200D 00	0.16298240D 00	-0.16230540D 00	0.16642590D 00
8	0.14652030D 00	-0.13060770D 00	0.12060670D 00	-0.11476790D 00	0.11224050D 00
9	0.13028390D 00	-0.11732670D 00	0.10409230D 00	-0.94707300D-01	0.88108020D-01
10	0.12659220D 00	-0.10894350D 00	0.95151210D-01	-0.85365490D-01	0.76503430D-01
11	0.14103250D 00	-0.12335200D 00	0.11196530D 00	-0.10509170D 00	0.10165700D 00
12	0.11955440D 00	-0.97050010D-01	0.81726960D-01	-0.69665070D-01	0.60795370D-01
13	0.12462010D 00	-0.10212400D 00	0.85715500D-01	-0.73453270D-01	0.64062940D-01
14	0.10922940D 00	-0.87011470D-01	0.71062340D-01	-0.59136320D-01	0.50119050D-01
15	0.10089950D 00	-0.80716750D-01	0.70675070D-01	-0.59259570D-01	0.50527060D-01
16	0.10431720D 00	-0.82079050D-01	0.66304080D-01	-0.54810000D-01	0.46231530D-01
17	0.10488360D 00	-0.83941500D-01	0.69519960D-01	-0.59378080D-01	0.52119260D-01
18	0.10354110D 00	-0.80953880D-01	0.72204960D-01	-0.61946520D-01	0.54735350D-01
19	0.10875090D 00	-0.85731990D-01	0.69641960D-01	-0.58169850D-01	0.49840400D-01
20	0.11184870D 00	-0.85845450D-01	0.74820050D-01	-0.64446500D-01	0.57246240D-01

Table A-2-1 (Continued): Group 5, $\theta = 0.2$

Session	Moments about Origin 1	2	3	4	5
1	0.21945000D 00	0.31538623D 00	0.26190960D 00	0.65698100D 00	0.51243670D 00
2	0.21377000D 00	0.25737549D 00	0.14043400D 00	0.16666650D 00	0.13639620D 00
3	0.19505000D 00	0.20015420D 00	0.10689610D 00	0.10252610D 00	0.62181450D-01
4	0.20317000D 00	0.14795335D 00	0.77498160D-01	0.62703710D-01	0.45812010D-01
5	0.20336000D 00	0.12003088D 00	0.61273260D-01	0.41928960D-01	0.29051360D-01
6	0.20166000D 00	0.11197665D 00	0.55736880D-01	0.31959900D-01	0.19495990D-01
7	0.20482000D 00	0.99327550D-01	0.41657400D-01	0.21066810D-01	0.11641490D-01
8	0.20161000D 00	0.88426150D-01	0.38566100D-01	0.19735390D-01	0.10846090D-01
9	0.20145000D 00	0.81972370D-01	0.36127820D-01	0.18903020D-01	0.10928250D-01
10	0.19747000D 00	0.78059070D-01	0.35436830D-01	0.19513520D-01	0.12027460D-01
11	0.19593000D 00	0.73275830D-01	0.31023880D-01	0.15251280D-01	0.82555170D-02
12	0.18634000D 00	0.65026340D-01	0.25633710D-01	0.11471060D-01	0.54962060D-02
13	0.18771000D 00	0.61330550D-01	0.22950020D-01	0.90058300D-02	0.44037020D-02
14	0.19016000D 00	0.62673060D-01	0.23045450D-01	0.95258200D-02	0.42063590D-02
15	0.19564000D 00	0.62054280D-01	0.22198310D-01	0.67792920D-02	0.37101040D-02
16	0.19802000D 00	0.60759580D-01	0.20858030D-01	0.79503580D-02	0.32370350D-02
17	0.19949000D 00	0.57596010D-01	0.19654760D-01	0.72760610D-02	0.26226600D-02
18	0.20160000D 00	0.59454220D-01	0.19629270D-01	0.71289660D-02	0.27408740D-02
19	0.20506000D 00	0.60759240D-01	0.20195640D-01	0.73472340D-02	0.28391490D-02
20	0.20616000D 00	0.59311940D-01	0.19554140D-01	0.69242060D-02	0.26532250D-02

Session	6	7	8	9	10
1	0.11714690D 01	0.11957420D 01	0.25860530D 01	0.32956420D 01	0.67316120D 01
2	0.15760760D 00	0.15011370D 00	0.16061620D 00	0.19697620D 00	0.23106650D 00
3	0.80199330D-01	0.76076390D-01	0.77407480D-01	0.79396390D-01	0.83753610D-01
4	0.39864210D-01	0.33833370D-01	0.31037290D-01	0.20465400D-01	0.27167110D-01
5	0.22161560D-01	0.17446790D-01	0.14264830D-01	0.11948400D-01	0.10194910D-01
6	0.12834740D-01	0.80997700D-02	0.60985350D-02	0.43751620D-02	0.32016050D-02
7	0.67011680D-02	0.40155770D-02	0.25144740D-02	0.16289110D-02	0.10881720D-02
8	0.65533520D-02	0.42726790D-02	0.29746080D-02	0.21865630D-02	0.16657190D-02
9	0.69043460D-02	0.46007690D-02	0.33113680D-02	0.24437750D-02	0.16546030D-02
10	0.81693650D-02	0.59336140D-02	0.45406190D-02	0.35904220D-02	0.29206670D-02
11	0.47934320D-02	0.29567930D-02	0.18952150D-02	0.12565270D-02	0.65314960D-03
12	0.27777350D-02	0.14004950D-02	0.79260600D-03	0.44175720D-03	0.25156850D-03
13	0.21206670D-02	0.10681710D-02	0.55825520D-03	0.30035080D-03	0.16036470D-03
14	0.19529010D-02	0.93912520D-03	0.46379660D-03	0.23379690D-03	0.11981790D-03
15	0.16468890D-02	0.76178000D-03	0.36293270D-03	0.17725600D-03	0.66360460D-04
16	0.13866600D-02	0.61770360D-03	0.26388910D-03	0.13373030D-03	0.64264390D-04
17	0.11446040D-02	0.46059010D-03	0.20766500D-03	0.91948480D-04	0.41561760D-04
18	0.11098960D-02	0.46002070D-03	0.20522050D-03	0.92767190D-04	0.43113650D-04
19	0.11541260D-02	0.45911650D-03	0.21470220D-03	0.97154090D-04	0.45306610D-04
20	0.10721320D-02	0.45183030D-03	0.19703170D-03	0.86345150D-04	0.43530250D-04

Table A-2-1 (Continued): Group 6, θ = 1.0

Session	Moments about Origin 1	2	3	4	5	6	7	8	9	10
1	0.11210300 01	0.13597260 01	0.42090310 01	0.10573110 02	0.29142860 02	0.65030320 02	0.25010330 03	0.78549470 03	0.24339960 04	0.75604850 04
2	0.10625330 01	0.14563210 01	0.22169960 01	0.35515700 01	0.79629100 01	0.18166090 02	0.45862400 02	0.12452280 03	0.35567770 03	0.10520520 04
3	0.10450500 01	0.12272550 01	0.15678290 01	0.21498120 01	0.31372540 01	0.48398380 01	0.76424420 01	0.13255730 02	0.23239370 02	0.41561080 02
4	0.10425700 01	0.11747310 01	0.14054650 01	0.17674170 01	0.23212770 01	0.31695510 01	0.44630720 01	0.65480030 01	0.98464460 01	0.15212550 02
5	0.10459500 01	0.11692310 01	0.13761470 01	0.16979240 01	0.21732460 01	0.26762350 01	0.39208490 01	0.54867850 01	0.76504800 01	0.11466760 02
6	0.10375400 01	0.11312920 01	0.12660100 01	0.15222500 01	0.16569540 01	0.23360150 01	0.30143550 01	0.37796650 01	0.53657070 01	0.73742920 01
7	0.10259300 01	0.11393390 01	0.12132930 01	0.13857110 01	0.16170160 01	0.19295410 01	0.23435060 01	0.28939400 01	0.36145100 01	0.45725060 01
8	0.10251300 01	0.10759980 01	0.12115930 01	0.13795740 01	0.16103950 01	0.19212550 01	0.22573420 01	0.26947930 01	0.36452520 01	0.46625520 01
9	0.10254800 01	0.10702600 01	0.11946380 01	0.13435420 01	0.15445510 01	0.18103370 01	0.21566510 01	0.26140660 01	0.32102560 01	0.39931900 01
10	0.10239500 01	0.10671590 01	0.11659390 01	0.13573910 01	0.15393360 01	0.18115900 01	0.22705550 01	0.26681320 01	0.35553910 01	0.42465760 01
11	0.10169400 01	0.10593600 01	0.11572620 01	0.12866310 01	0.14667050 01	0.17129490 01	0.20482400 01	0.25068810 01	0.31393760 01	0.40207930 01
12	0.10191000 01	0.10702750 01	0.11552290 01	0.12790660 01	0.14508150 01	0.16842050 01	0.19990070 01	0.24265870 01	0.30060350 01	0.38063300 01
13	0.10163400 01	0.10640930 01	0.11394160 01	0.12463060 01	0.13978250 01	0.15986970 01	0.18603640 01	0.22226530 01	0.26982320 01	0.33361550 01
14	0.10170200 01	0.10636600 01	0.11321450 01	0.12357920 01	0.13791520 01	0.15737400 01	0.18304040 01	0.21913380 01	0.26732360 01	0.33318110 01
15	0.10154400 01	0.10556920 01	0.11214560 01	0.12160150 01	0.13451490 01	0.15175170 01	0.17454590 01	0.20460950 01	0.24433020 01	0.29699520 01
16	0.10127200 01	0.10534060 01	0.11137570 01	0.12057350 01	0.13315460 01	0.14969480 01	0.17188380 01	0.20064610 01	0.23823110 01	0.28745930 01
17	0.10160230 01	0.10546840 01	0.11165810 01	0.12029510 01	0.13174750 01	0.14655410 01	0.16557140 01	0.18922060 01	0.21535590 01	0.25746020 01
18	0.10166100 01	0.10546190 01	0.11145700 01	0.11969280 01	0.13099670 01	0.14528460 01	0.16349540 01	0.18621730 01	0.21464510 01	0.25075550 01
19	0.10198900 01	0.10534330 01	0.11227590 01	0.12091550 01	0.13232430 01	0.14700430 01	0.16562440 01	0.18905980 01	0.21644470 01	0.25524520 01
20	0.10201300 01	0.10594480 01	0.11190130 01	0.12010820 01	0.13091130 01	0.14479090 01	0.16238750 01	0.18454000 01	0.21233900 01	0.24719760 01

Table A-2-1 (Continued): Group 7, θ = 1.8

Session	Moments about Origin 1	2	3	4	5	6	7	8	9	10
1	0.20676500 01	0.51030710 01	0.13901030 02	0.40248480 02	0.12069350 03	0.36923560 03	0.11425020 04	0.35581310 04	0.11122410 05	0.34842210 05
2	0.18652700 01	0.37926390 01	0.84859060 01	0.20599380 02	0.53464890 02	0.14635520 03	0.41704020 03	0.12235780 04	0.36652100 04	0.11139940 05
3	0.18114500 01	0.35135740 01	0.72936100 01	0.16221570 02	0.38442560 02	0.96561260 02	0.25502630 03	0.70196360 03	0.19965340 04	0.58238360 04
4	0.18112700 01	0.34274190 01	0.67827960 01	0.14057260 02	0.30553700 02	0.69713940 02	0.16693590 03	0.41891210 03	0.10972730 04	0.29852110 04
5	0.18059600 01	0.33785930 01	0.65122930 01	0.12966500 02	0.26860510 02	0.57843770 02	0.12999060 03	0.30551950 03	0.75120050 03	0.19267010 04
6	0.17889600 01	0.32715570 01	0.61054790 01	0.11615990 02	0.22487110 02	0.44243880 02	0.88367740 02	0.17897070 03	0.36718700 03	0.76246040 03
7	0.17947900 01	0.32828600 01	0.61134570 01	0.11561060 02	0.22300650 02	0.43622490 02	0.86529320 02	0.17455300 03	0.35665090 03	0.73849940 03
8	0.17943100 01	0.32883270 01	0.60424060 01	0.11327250 02	0.21524950 02	0.41447210 02	0.8[illegible]40720 02	0.15960060 03	0.32918930 03	0.64568250 03
9	0.18061800 01	0.33039390 01	0.61457100 01	0.11568500 02	0.22060160 02	0.42646200 02	[illegible] 02	0.16556130 03	0.33293640 03	0.67779060 03
10	0.17959400 01	0.32888270 01	0.60144670 01	0.11206530 02	0.21129800 02	0.40319100 02	[illegible]320 02	0.15224830 03	0.30165220 03	0.60527390 03
11	0.18009870 01	0.32772240 01	0.60226790 01	0.11173360 02	0.20919590 02	0.39517490 02	0.[illegible]240 02	0.14471470 03	0.26044450 03	0.54793720 03
12	0.17938430 01	0.32654033 01	0.59356460 01	0.11268090 02	0.20646010 02	0.38846310 02	0.73714300 02	0.14105320 03	0.27213120 03	0.52925950 03
13	0.18031830 01	0.32614200 01	0.60253860 01	0.11161930 02	0.20857730 02	0.37311300 02	0.74721100 02	0.14321780 03	0.27077370 03	0.53925930 03
14	0.18034300 01	0.32809470 01	0.60209470 01	0.11144590 02	0.20804520 02	0.39166690 02	0.74361500 02	0.14254820 03	0.27472380 03	0.53446420 03
15	0.18010800 01	0.32726200 01	0.59990410 01	0.11093770 02	0.20695150 02	0.38942570 02	0.73911040 02	0.14148040 03	0.27310060 03	0.53153820 03
16	0.18028430 01	0.32739590 01	0.59970160 01	0.11075410 02	0.20622780 02	0.38710220 02	0.73279680 02	0.13982900 03	0.26896060 03	0.52149680 03
17	0.18009700 01	0.32583510 01	0.59773220 01	0.11013670 02	0.20445040 02	0.38232000 02	0.72010300 02	0.13659470 03	0.26089980 03	0.50164500 03
18	0.18039400 01	0.32760350 01	0.60003240 01	0.11063360 02	0.20546640 02	0.33434410 02	0.72411220 02	0.13735590 03	0.26293930 03	0.50516270 03
19	0.18035700 01	0.32771910 01	0.59950430 01	0.11062380 02	0.20548510 02	0.36444750 02	0.72444040 02	0.13748080 03	0.26273300 03	0.50558250 03
20	0.17999200 01	0.32621040 01	0.59526050 01	0.10937380 02	0.20233050 02	0.37683640 02	0.70061560 02	0.13339280 03	0.25350490 03	0.48498140 03

Table A-2-1 (Continued): Group 8, θ = 2.6

Session	Moments about Origin 1	2	3	4	5	6	7	8	9	10
1	0.28145730D 01	0.824[illegible] 01	0.24817020D 02	0.75965910D 02	0.23497040D 03	0.73142700D 03	0.22854740D 04	0.71575070D 04	0.22445440D 05	0.70443070D 05
2	0.28163700D 01	0.81427830D 01	0.24050690D 02	0.72210510D 02	0.21955670D 03	0.67368200D 03	0.20810430D 04	0.64597550D 04	0.20121730D 05	0.62334330D 05
3	0.275[illegible] 01	0.77792510D 01	0.22369750D 02	0.65435270D 02	0.19420680D 03	0.58336550D 03	0.17695560D 04	0.54098860D 04	0.16641830D 05	0.51442340D 05
4	0.2731260[illegible] 01	0.7559[illegible] 01	0.21519650D 02	0.61925500D 02	0.16077320D 03	0.53445510D 03	0.15974390D 04	0.48189300D 04	0.1464[illegible] 05	0.44821360D 05
5	0.27315600D 01	0.75616210D 01	0.21370490D 02	0.61112430D 02	0.17719020D 03	0.51996710D 03	0.15424710D 04	0.46197120D 04	0.13946240D 05	0.42399020D 05
6	0.2736029[illegible] 01	0.7416[illegible] 01	0.20602990D 02	0.57950620D 02	0.16506130D 03	0.47564650D 03	0.13857510D 04	0.40781440D 04	0.12111640D 05	0.30264570D 05
7	0.2731[illegible] 01	0.7362[illegible] 01	0.20599680D 02	0.57010000D 02	0.16116430D 03	0.46056860D 03	0.13300860D 04	0.38794100D 04	0.11419510D 05	0.33399270D 05
8	0.26[illegible] 01	0.73[illegible] 01	0.20210080D 02	0.56220690D 02	0.15810940D 03	0.44923960D 03	0.12893670D 04	0.37364230D 04	0.10926360D 05	0.32222610D 05
9	0.26[illegible] 01	0.7261[illegible] 01	0.19954480D 02	0.55119670D 02	0.15374290D 03	0.43425180D 03	0.12370320D 04	0.35575460D 04	0.10324640D 05	0.30222960D 05
10	0.25735150D 01	0.71677140D 01	0.19508480D 02	0.53404150D 02	0.14745020D 03	0.41091730D 03	0.11551900D 04	0.32764660D 04	0.93744150D 04	0.27049600D 05
11	0.2674[illegible] 01	0.7207[illegible] 01	0.19575170D 02	0.5359[illegible] 02	0.14777170D 03	0.41194670D 03	0.11565340D 04	0.32742970D 04	0.93469730D 04	0.26399360D 05
12	0.2667[illegible] 01	0.7[illegible] 01	0.19386150D 02	0.52642030D 02	0.14514780D 03	0.40182550D 03	0.11212900D 04	0.31540990D 04	0.89433940D 04	0.25559940D 05
13	0.26634130D 01	0.71[illegible]7320D 01	0.19188130D 02	0.52047590D 02	0.14216710D 03	0.39113270D 03	0.10840670D 04	0.30272960D 04	0.85183400D 04	0.24152580D 05
14	0.2643[illegible] 01	0.705[illegible] 01	0.18937360D 02	0.51139280D 02	0.13900500D 03	0.38090720D 03	0.10510940D 04	0.29225000D 04	0.81884420D 04	0.23120480D 05
15	0.2634[illegible]230D 01	0.69765940D 01	0.18532490D 02	0.49759930D 02	0.13402960D 03	0.36322030D 03	0.99057250D 03	0.27191910D 04	0.75146660D 04	0.20910310D 05
16	0.2630[illegible] 01	0.69500500D 01	0.13659080D 02	0.50018170D 02	0.13464840D 03	0.36571980D 03	0.99801380D 03	0.27409580D 04	0.75775290D 04	0.21090160D 05
17	0.26292430D 01	0.69413570D 01	0.18404620D 02	0.49019240D 02	0.13117650D 03	0.35276940D 03	0.95360510D 03	0.25917080D 04	0.70833460D 04	0.19472240D 05
18	0.26145130D 01	0.6850[illegible] 01	0.18033790D 0[illegible]	0.47563150D 02	0.12595220D 03	0.33448450D 03	0.89124450D 03	0.23828820D 04	0.63933450D 04	0.17215160D 05
19	0.26127230D 01	0.68452[illegible] 01	0.17985560D 02	0.47594670D 02	0.12527060D 03	0.33213640D 03	0.88343430D 03	0.23575780D 04	0.63130290D 04	0.16764360D 05
20	0.26150900D 01	0.66555740D 01	0.17999470D 02	0.47375690D 02	0.12496860D 03	0.33036320D 03	0.87524620D 03	0.23238870D 04	0.61836190D 04	0.16489550D 05

TABLE A-2-2

Ten Sample Moments about the Mean of the Maximum Likelihood Estimates of the 100 Hypothetical Examinees after the Completion of Each of the Twenty Sessions. Group 1, $\theta = -3.0$.

Session	Moments about Mean 1	2	3	4	5
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	-0.1683098D-14	0.3193578D-02	0.1777896D-02	0.9998494D-03	0.5622347D-03
6	-0.2697842D-14	0.1274539D-01	0.5941901D-02	0.2932559D-02	0.1442891D-02
7	-0.2380318D-14	0.1299456D-01	0.5488902D-02	0.2487371D-02	0.1121991D-02
8	-0.1958433D-14	0.1137030D-01	0.4492632D-02	0.1904412D-02	0.8035539D-03
9	-0.1287859D-14	0.1009160D-01	0.3756496D-02	0.1500158D-02	0.5963279D-03
10	-0.2036149D-14	0.1046815D-01	0.3610045D-02	0.1354542D-02	0.5049178D-03
11	-0.1620926D-14	0.1155118D-01	0.3743586D-02	0.1315472D-02	0.4567986D-03
12	-0.5506706D-14	0.1205604D-01	0.3530069D-02	0.1178935D-02	0.3877500D-03
13	-0.4980460D-14	0.1325601D-01	0.3933734D-02	0.1387038D-02	0.4958302D-03
14	-0.1301181D-14	0.1402609D-01	0.3773114D-02	0.1250907D-02	0.4161684D-03
15	-0.1287859D-14	0.1530150D-01	0.3618562D-02	0.1124780D-02	0.3433202D-03
16	-0.2784439D-14	0.1692024D-01	0.3401316D-02	0.1001739D-02	0.2770542D-03
17	-0.4374279D-14	0.1719879D-01	0.3384130D-02	0.1012681D-02	0.2850512D-03
18	-0.6790124D-14	0.1752381D-01	0.3360063D-02	0.1013755D-02	0.2853053D-03
19	-0.1971756D-14	0.1818418D-01	0.3383959D-02	0.1086057D-02	0.3324742D-03
20	-0.4169998D-14	0.1831968D-01	0.2947546D-02	0.9277228D-03	0.2632059D-03

Session	Moments about Mean 6	7	8	9	10
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.3161556D-03	0.1777807D-03	0.9996967D-04	0.5621494D-04	0.3161079D-04
6	0.7100524D-03	0.3494106D-03	0.1719479D-03	0.8461557D-04	0.4163932D-04
7	0.5062514D-03	0.2284204D-03	0.1030633D-03	0.4650215D-04	0.2098177D-04
8	0.3591559D-03	0.1431432D-03	0.6341500D-04	0.2547870D-04	0.1076201D-04
9	0.2571161D-03	0.9428200D-04	0.3748641D-04	0.1490614D-04	0.5920980D-05
10	0.1883055D-03	0.7022459D-04	0.2618866D-04	0.9788612D-05	0.3642265D-05
11	0.1566040D-03	0.5520462D-04	0.1919025D-04	0.6670913D-05	0.2318943D-05
12	0.1277465D-03	0.4207890D-04	0.1386082D-04	0.4565792D-05	0.1503959D-05
13	0.1840074D-03	0.7061964D-04	0.2823780D-04	0.1162295D-04	0.4914311D-05
14	0.1440519D-03	0.5176976D-04	0.1931928D-04	0.7462422D-05	0.2966557D-05
15	0.1055649D-03	0.3654150D-04	0.1255122D-04	0.4502104D-05	0.1669153D-05
16	0.6124465D-04	0.2472647D-04	0.7873163D-05	0.2813809D-05	0.9030469D-06
17	0.6600251D-04	0.2697090D-04	0.8012139D-05	0.2975027D-05	0.1030554D-05
18	0.6639052D-04	0.2705597D-04	0.8778028D-05	0.2921557D-05	0.9911637D-06
19	0.1143064D-03	0.4169733D-04	0.1559775D-04	0.6345094D-05	0.2574128D-05
20	0.6640721D-04	0.3004380D-04	0.1104135D-04	0.4198250D-05	0.1633570D-05

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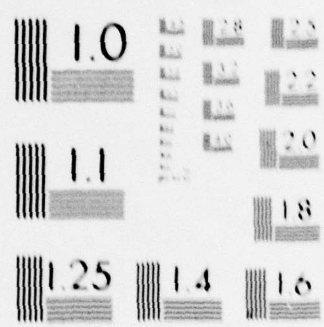

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table A-2-2 (Continued): Group 2, $\theta = -2.2$

Session	Moments about Mean: 1	2	3	4	5	6	7	8	9	10
1	-0.13399970D-14	0.54060470D 00	0.30022150D 00	0.62414570D 00	0.65819050D 00	0.15823660D 01	0.29596420D 01	0.59462380D 01	0.12289330D 02	0.25981960D 02
2	-0.77049480D-15	0.33925170D 00	-0.23005660D-01	0.16401750D 00	0.10144840D-01	0.10598840D 00	0.32066960D-01	0.81293720D-01	0.47143120D-01	0.74072980D-01
3	-0.11390890D-14	0.21627960D 00	-0.54745450D-01	0.11146110D 00	-0.46237720D-01	0.66136140D-01	-0.32180840D-01	0.41118950D-01	-0.21174620D-01	0.26141240D-01
4	-0.22314680D-14	0.16555920D 00	-0.45505590D-01	0.65018830D-01	-0.40916360D-01	0.55638500D-01	-0.31037960D-01	0.38205060D-01	-0.22430390D-01	0.26767380D-01
5	-0.20694500D-14	0.68405000D-01	-0.16475190D-01	0.33659410D-01	-0.16931760D-01	0.21026370D-01	-0.14581840D-01	0.15342870D-01	-0.11799770D-01	0.11223160D-01
6	-0.22537250D-14	0.75005350D-01	-0.67006520D-02	0.20970240D-01	-0.78941820D-02	0.11282280D-01	-0.71294900D-02	0.76720080D-02	-0.58691510D-02	0.56389840D-02
7	-0.15070830D-14	0.51152250D-01	0.57601720D-03	0.67300970D-02	0.14079650D-03	0.11242860D-02	0.45034510D-04	0.20577570D-03	0.14085230D-04	0.39505480D-04
8	-0.23092640D-14	0.44770110D-01	-0.23165560D-02	0.55959920D-02	-0.62787320D-03	0.11057120D-02	-0.12751310D-03	0.23281740D-03	-0.20787620D-04	0.52556580D-04
9	-0.20420100D-14	0.45734240D-01	-0.30320870D-02	0.65139650D-02	-0.10617170D-02	0.12981590D-02	-0.27271410D-03	0.29098900D-03	-0.67546710D-04	0.68411000D-04
10	-0.19761970D-14	0.45745350D-01	-0.27059560D-02	0.62626830D-02	-0.10925820D-02	0.12363010D-02	-0.33993920D-03	0.27918530D-03	-0.96642140D-04	0.67032310D-04
11	-0.16455510D-14	0.40172700D-01	-0.19112780D-02	0.46755570D-02	-0.71217220D-03	0.88783810D-03	-0.23350070D-03	0.19989010D-03	-0.72291980D-04	0.50624300D-04
12	-0.23669950D-14	0.34407220D-01	-0.10066490D-02	0.31987150D-02	-0.23547650D-03	0.39511700D-03	-0.46497060D-04	0.55959010D-04	-0.86875040D-05	0.85498640D-05
13	-0.12279070D-14	0.32410720D-01	-0.10703490D-02	0.30503080D-02	-0.22415220D-03	0.39498450D-03	-0.41356210D-04	0.59854460D-04	-0.75608590D-05	0.97934610D-05
14	-0.15957210D-14	0.29517260D-01	-0.10734720D-02	0.24378530D-02	-0.23968750D-03	0.27878210D-03	-0.46054010D-04	0.37787480D-04	-0.87307630D-05	0.57713310D-05
15	-0.17408300D-14	0.27360210D-01	-0.55380800D-03	0.22706310D-02	-0.62573580D-04	0.26325850D-03	-0.13416690D-05	0.35765090D-04	0.15217520D-05	0.53677720D-05
16	-0.17052550D-14	0.26012740D-01	-0.68054120D-03	0.20682530D-02	-0.12393460D-03	0.21058470D-03	-0.18928050D-04	0.26416310D-04	-0.28660460D-05	0.34583010D-05
17	-0.12070590D-14	0.25159990D-01	-0.43465770D-03	0.15162450D-02	-0.14012490D-03	0.21460860D-03	-0.28504360D-04	0.28478630D-04	-0.52957390D-05	0.41488670D-05
18	-0.18516080D-14	0.23134910D-01	-0.64623350D-03	0.16240600D-02	-0.16338130D-03	0.17496370D-03	-0.31762870D-04	0.23210280D-04	-0.56933800D-05	0.34806740D-05
19	-0.12034820D-14	0.22115970D-01	-0.10396610D-02	0.15011050D-02	-0.22867610D-03	0.16648970D-03	-0.43335860D-C4	0.23968060D-04	-0.81660460D-05	0.39934520D-05
20	-0.16942000D-14	0.19907050D-01	-0.76061200D-03	0.11424600D-02	-0.14271950D-03	0.10465130D-03	-0.22215730D-04	0.11944370D-04	-0.32964890D-05	0.15202100D-05

Table A-2-2 (Continued): Group 3, $\theta = -1.4$

Session	Moments about Mean 1	2	3	4	5
1	-0.14521720-14	0.65539980 00	-0.41486540 00	0.13002090 01	-0.15180580 01
2	-0.43520740-15	0.24354560 00	-0.32139900-01	0.21523710 00	-0.11437900 00
3	-0.16565920-14	0.17225890 00	-0.51449920-01	0.13141910 00	-0.14254340 00
4	-0.14722950-14	0.10879320 00	-0.15466720-01	0.46632930-01	-0.14911340-01
5	-0.18704430-14	0.81387930-01	-0.12660250-01	0.22904680-01	-0.90963300-02
6	-0.10763610-14	0.68150220-01	-0.93619650-02	0.15374570-01	-0.57582960-02
7	-0.17399970-14	0.53832710-01	-0.62682710-02	0.10497320-01	-0.33951020-02
8	-0.12823080-14	0.56514870-01	-0.51171630-02	0.78775360-02	-0.18008320-02
9	-0.14223340-14	0.49237750-01	-0.41785610-02	0.61174710-02	-0.12050840-02
10	-0.16256440-14	0.46451120-01	-0.34522410-02	0.57898860-02	-0.10134670-02
11	-0.14988010-14	0.40621450-01	-0.31269620-02	0.42866200-02	-0.86251740-03
12	-0.12967400-14	0.36314340-01	-0.17226450-02	0.32907390-02	-0.39618410-03
13	-0.14255260-14	0.31724420-01	-0.20711230-02	0.26977700-02	-0.46972930-03
14	-0.18851590-14	0.27903270-01	-0.18936630-02	0.22429100-02	-0.41540490-03
15	-0.18141040-14	0.27496230-01	-0.16193250-02	0.21218230-02	-0.32926920-03
16	-0.16830980-14	0.26507150-01	-0.12640660-02	0.18947320-02	-0.17220710-03
17	-0.18389290-14	0.25476720-01	-0.16536980-02	0.18923070-02	-0.27278390-03
18	-0.11324270-14	0.24597400-01	-0.18505020-02	0.19160280-02	-0.39736040-03
19	-0.14810380-14	0.24584650-01	-0.17160900-02	0.17879990-02	-0.31104230-03
20	-0.15165650-14	0.23474810-01	-0.15931080-02	0.14838080-02	-0.22803850-03

Session	Moments about Mean 6	7	8	9	10
1	[illegible]	[illegible]	0.41276270 01	[illegible]	[illegible]
2	0.16131440 00	[illegible]	0.45317620 00	[illegible]	0.23133840 01
3	[illegible]	[illegible]	0.60565460 00	-0.11340370 01	0.19257360 01
4	[illegible]	[illegible]	0.20565200-01	-0.14641050-01	0.27201110-01
5	[illegible]	[illegible]	0.63704160-02	-0.45621060-02	[illegible]
6	[illegible]	[illegible]	0.30540350-02	-0.21659260-02	0.16037710-02
7	[illegible]	[illegible]	0.15178870-02	[illegible]	0.70647430-03
8	[illegible]	[illegible]	0.45339260-03	-0.23196040-03	0.14600640-03
9	[illegible]	[illegible]	0.21045600-03	-0.73509900-04	0.45621860-04
10	[illegible]	[illegible]	0.23318360-03	[illegible]	0.60887310-04
11	0.68024330-03	[illegible]	0.13260580-03	[illegible]	0.28705500-04
12	[illegible]	[illegible]	0.59299430-04	-0.14967790-04	0.42323260-05
13	[illegible]	[illegible]	0.56730680-04	[illegible]	0.10764230-04
14	[illegible]	[illegible]	0.47911340-04	-0.17562320-04	0.90882050-05
15	[illegible]	[illegible]	0.32779440-04	-0.10151590-04	0.49960040-05
16	0.18439230-03	-0.21814790-04	0.20283750-04	-0.27760520-05	0.23749600-05
17	[illegible]	[illegible]	0.27374400-04	[illegible]	0.39327560-05
18	[illegible]	[illegible]	0.36556070-04	-0.14553540-04	0.67548750-05
19	[illegible]	[illegible]	0.29127930-04	[illegible]	[illegible]
20	[illegible]	[illegible]	0.14177560-04	-0.41602100-05	0.17950670-05

Table A-2-2 (Continued): Group 4, $\theta = -0.6$

Session	Moments about Mean 1	2	3	4	5	6	7	8	9	10
1	-0.44630970-15	0.65520740 00	-0.33274490 00	0.17293950 01	-0.23710930 01	0.79703870 01	-0.15293660 02	0.44209230 02	-0.96075010 02	0.25921170 03
2	-0.89595000-15	0.21492140 00	-0.36532470-01	0.15102880 00	-0.10850840 00	0.22136350 00	-0.27856730 00	0.47254460 00	-0.70806820 00	0.11496660 01
3	-0.11368680-14	0.12857300 00	0.32924250-02	0.46638440-01	0.22468410-02	0.30206970-01	0.14656310-02	0.26570820-01	0.11695270-02	0.26289570-01
4	-0.11766980-14	0.10171460 00	0.10290590-01	0.32448240-01	0.89475520-02	0.15892300-01	0.71673950-02	0.94359860-02	0.55799490-02	0.62035160-02
5	-0.11672610-14	0.74567190-01	0.49079610-02	0.18296570-01	0.40104290-02	0.81686390-02	0.34374600-02	0.50016140-02	0.24145490-02	0.35061090-02
6	-0.12095680-14	0.71424220-01	0.17128030-02	0.12377020-01	0.69588330-03	0.32138810-02	0.26066660-03	0.10262490-02	0.94902180-04	0.36460150-03
7	-0.84030010-15	0.62919470-01	0.12259110-02	0.10035610-01	0.18709120-03	0.23188620-02	-0.65676760-04	0.66030710-03	-0.73945860-04	0.21447500-03
8	-0.11023130-14	0.55233850-01	0.20265330-02	0.82293400-02	0.50835110-03	0.17203990-02	0.76156690-04	0.43993180-03	-0.25368720-05	0.12751580-03
9	-0.96728180-15	0.47008540-01	0.22176380-02	0.61253030-02	0.56815180-03	0.10872980-02	0.13750730-03	0.22412820-03	0.34954800-04	0.50378670-04
10	-0.90816240-15	0.42037250-01	0.12026120-02	0.48075440-02	0.33346990-03	0.82686770-03	0.83674050-04	0.17797690-03	0.22446470-04	0.43171190-04
11	-0.12961850-14	0.45259600-01	0.21350640-02	0.63805620-02	0.70751240-03	0.14127400-02	0.21194920-03	0.38449760-03	0.64349690-04	0.11514540-03
12	-0.11882160-14	0.39310850-01	0.33710560-02	0.50106240-02	0.12519780-02	0.10815550-02	0.44946010-03	0.31126880-03	0.16194450-03	0.10338440-03
13	-0.86403110-15	0.35291830-01	0.16311980-02	0.36715550-02	0.62824610-03	0.65589900-03	0.21061750-03	0.15713600-03	0.67821930-04	0.43390890-04
14	-0.10309810-14	0.36053450-01	0.10340670-02	0.27365780-02	0.41192620-03	0.43341830-03	0.13072750-03	0.92990620-04	0.38607040-04	0.23246220-04
15	-0.10629000-14	0.29524370-01	0.12795580-02	0.27751610-02	0.43002600-03	0.45212430-03	0.13544610-03	0.99363640-04	0.40951560-04	0.25437120-04
16	-0.12732870-14	0.26518490-01	0.11269430-02	0.23859070-02	0.33368540-03	0.34249550-03	0.84955700-04	0.62057820-04	0.20724630-04	0.12745630-04
17	-0.12043140-14	0.24697450-01	0.59211560-04	0.20483090-02	-0.13565200-04	0.26328680-03	-0.38990110-05	0.40045640-04	-0.80692320-06	0.65893640-05
18	-0.10075270-14	0.23340660-01	0.16988740-03	0.19256520-02	-0.28537750-04	0.24380580-03	-0.13180130-04	0.35025480-04	-0.35694100-05	0.54962810-05
19	-0.13367090-14	0.23412930-01	0.69054530-03	0.18121450-02	0.95502800-04	0.21514540-03	0.14735990-04	0.29860240-04	0.25026800-05	0.44552140-05
20	-0.99864560-15	0.24110130-01	0.69824360-03	0.22045910-02	0.13098060-03	0.33839840-03	0.33364880-04	0.63429090-04	0.93557150-05	0.13001460-04

Table A-2-2 (Continued): Group 5, θ = 0.2

Session	Moments about Mean 1	2	3	4	5	6	7	8	9	10
1	0.1112443D-14	0.4708866D 00	-0.3872897D-01	0.5545504D 00	-0.1277961D 00	0.9307154D 00	-0.3116739D 00	0.1863469D 01	-0.6634962D 00	0.4394600D 01
2	0.1136868D-14	0.2116783D 00	-0.5086169D-02	0.1108882D 00	-0.1225152D-02	0.7743683D-01	0.1867165D-02	0.6235967D-01	0.4335043D-02	0.5525933D-01
3	0.2345346D-15	0.1621097D 00	0.4619071D-02	0.6047059D-01	0.9138404D-02	0.3064644D-01	0.1064105D-01	0.1864421D-01	0.9558953D-02	0.1322095D-01
4	0.2242651D-15	0.1078553D 00	0.4595545D-02	0.3147980D-01	0.3489097D-02	0.1335394D-01	0.2315747D-02	0.6950231D-02	0.1534644D-02	0.4087930D-02
5	0.1967870D-15	0.7866738D-01	0.4962654D-02	0.1665709D-01	0.3094182D-02	0.5146221D-02	0.1641927D-02	0.1944995D-02	0.3644955D-03	0.8247664D-03
6	0.2828293D-15	0.6350617D-01	0.1123074D-02	0.1014747D-01	0.4871532D-03	0.2221671D-02	0.1717335D-03	0.5766585D-03	0.6094331D-04	0.1655951D-03
7	0.2674253D-15	0.5245816D-01	0.8881271D-03	0.6008519D-02	0.2693667D-03	0.9914737D-03	0.9247464D-04	0.2353006D-03	0.3265977D-04	0.4893266D-04
8	0.2717271D-15	0.4777956D-01	0.1472831D-02	0.5243036D-02	0.7136816D-03	0.1000741D-02	0.3144512D-03	0.2795072D-03	0.1296006D-03	0.9449794D-04
9	0.2596534D-15	0.4139027D-01	0.2938346D-02	0.4810172D-02	0.1175227D-02	0.9696495D-03	0.4212764D-03	0.2647291D-03	0.1524238D-03	0.9679953D-04
10	0.2460532D-15	0.3904467D-01	0.4600153D-02	0.5217924D-02	0.1771628D-02	0.1358502D-02	0.7036210D-03	0.4884756D-03	0.2626527D-03	0.1578864D-03
11	0.2335101D-15	0.3485907D-01	0.2995676D-02	0.3395199D-02	0.8478397D-03	0.5644971D-03	0.2233967D-03	0.1262214D-03	0.5995716D-04	0.3244254D-04
12	0.2156608D-15	0.3030374D-01	0.2223101D-02	0.2295039D-02	0.4036216D-03	0.2566967D-03	0.6697034D-04	0.3643185D-04	0.1239634D-04	0.5994121D-05
13	0.2159384D-15	0.2609549D-01	0.1640698D-02	0.1695422D-02	0.2753011D-03	0.1677643D-03	0.4453474D-04	0.2193835D-04	0.7470265D-05	0.3407275D-05
14	0.2121914D-15	0.2650923D-01	0.1046119D-02	0.1670920D-02	0.1678434D-03	0.1439635D-03	0.2254487D-04	0.1470316D-04	0.2994504D-05	0.1678214D-05
15	0.3261283D-15	0.2368095D-01	0.7741621D-03	0.1252411D-02	0.1200481D-03	0.9209113D-04	0.1544075D-04	0.8330996D-05	0.1930778D-05	0.8660098D-06
16	0.3834433D-15	0.2124766D-01	0.4714585D-03	0.1040349D-02	0.6780506D-04	0.7065403D-04	0.6099312D-05	0.5756609D-05	0.9194200D-06	0.5230235D-06
17	0.2768619D-15	0.1960035D-01	0.1855779D-03	0.8661112D-03	0.1292027D-04	0.5399791D-04	0.3236143D-06	0.4056264D-05	0.6426277D-07	0.3413652D-06
18	0.4032885D-15	0.1879166D-01	0.7053712D-04	0.8298399D-03	0.3018355D-05	0.5604330D-04	-0.3933623D-07	0.4602073D-05	-0.1177651D-07	0.4673863D-06
19	0.3318179D-15	0.1829027D-01	0.1358589D-03	0.7713155D-03	0.1454254D-04	0.4977576D-04	0.1341082D-05	0.4076853D-05	0.5543553D-07	0.3794474D-06
20	0.2960132D-15	0.1680175D-01	0.1468384D-03	0.7105159D-03	0.1310977D-04	0.4489594D-04	0.7601672D-06	0.3517797D-05	0.2366362D-07	0.3115403D-06

Table A-2-2 (Continued): Group 6, θ = 1.0

Session	Moments about Mean 1	2	3	4	5	6	7	8	9	10
1	[illegible]	[illegible]	0.40228110D 00	0.16135910D 01	0.21064070D 01	0.64642620D 01	0.93907550D 01	0.25132290D 02	0.39890720D 02	0.10328220D 03
2	[illegible]	[illegible]	0.86549350D-01	0.32560850D 00	0.36323670D 00	0.90837950D 00	0.15537900D 01	0.34165650D 01	0.66305490D 01	0.13981320D 02
3	[illegible]	0.13512550D 00	0.28612830D-02	0.59656930D-01	0.55471930D-02	0.42225790D-01	0.53387580D-02	0.37344380D-01	0.45157260D-02	0.36746320D-01
4	0.15213060D-14	[illegible]	-0.24038080D-02	0.25966590D-01	-0.16774460D-02	0.10296420D-01	-0.97874090D-03	0.56267280D-02	-0.67273910D-03	0.34610330D-02
5	0.17674590D-14	0.75220310D-01	-0.21635320D-02	0.16363220D-01	-0.12558100D-02	0.52755590D-02	-0.72335540D-03	0.20572950D-02	-0.39985830D-03	0.88544740D-03
6	[illegible]	0.55218220D-01	-0.84773390D-04	0.81520540D-02	0.34831760D-04	0.17952470D-02	0.65149950D-04	0.48427220D-03	0.41333700D-04	0.14536660D-03
7	[illegible]	0.46750690D-01	-0.37941350D-02	0.60361230D-02	-0.13614820D-02	0.11576610D-02	-0.40517940D-03	0.27039650D-03	-0.11651350D-03	0.49381130D-04
8	0.16675550D-14	0.44550470D-01	-0.25624610D-02	0.51612840D-02	-0.51504220D-03	0.85467720D-03	-0.79682560D-04	0.16966460D-03	-0.69280260D-05	0.37235150D-04
9	0.13760770D-14	0.38658750D-01	-0.24517640D-02	0.34701330D-02	-0.53771430D-03	0.56036630D-03	-0.10794350D-03	0.92787700D-04	-0.22099470D-04	0.16954930D-04
10	[illegible]	0.38633710D-01	-0.23609640D-02	0.47243130D-02	-0.43324260D-03	0.84657200D-03	-0.67185500D-04	0.17728620D-03	-0.80515550D-05	0.40193620D-04
11	0.13357050D-14	0.34555720D-01	-0.86321590D-03	0.41301650D-02	0.28346550D-04	0.76275370D-03	0.63330100D-04	0.17138980D-03	0.30978760D-04	0.43521750D-04
12	0.16520120D-14	0.31711490D-01	-0.12358130D-03	0.33679350D-02	0.83997810D-04	0.56109010D-03	0.51238320D-04	0.11505170D-03	0.20241200D-04	0.26598960D-04
13	0.12450730D-14	0.27637780D-01	-0.92517670D-04	0.26664060D-02	-0.65580510D-05	0.39384260D-03	-0.12468770D-05	0.68255720D-04	-0.61604820D-07	0.12863690D-04
14	0.12945290D-14	0.26330280D-01	-0.12388970D-03	0.30540900D-02	-0.11862190D-03	0.59472660D-03	-0.68798100D-04	0.14543060D-03	-0.29031260D-04	0.39416650D-04
15	0.18407500D-14	0.24573630D-01	-0.44185310D-03	0.25746600D-02	-0.28367720D-03	0.48502350D-03	-0.12358100D-03	0.11909070D-03	-0.45126610D-04	0.33393120D-04
16	0.19162450D-14	0.24603920D-01	-0.24900360D-03	0.22514530D-02	-0.16502780D-03	0.34536740D-03	-0.59450120D-04	0.67032250D-04	-0.17975530D-04	0.14652080D-04
17	0.11677550D-14	0.22567500D-01	-0.11011350D-02	0.18671700D-02	-0.35508730D-03	0.30134570D-03	-0.98059040D-04	0.63633310D-04	-0.26317280D-04	0.15196670D-04
18	0.17696960D-14	0.21525020D-01	-0.73387160D-03	0.15543000D-02	-0.23881610D-03	0.70811410D-03	-0.58254890D-04	0.36909140D-04	-0.13344660D-04	0.73336580D-05
19	0.15631760D-14	0.20274420D-01	-0.15631860D-03	0.12202610D-02	-0.11018950D-03	0.13549990D-03	-0.28709760D-04	0.20365960D-04	-0.61953870D-05	0.35037430D-05
20	0.17447110D-14	0.18782550D-01	-0.81999610D-04	0.11553640D-02	-0.10855220D-03	0.13650590D-03	-0.30573870D-04	0.21937120D-04	-0.70381670D-05	0.40388410D-05

Table A-2-2 (Continued): Group 7, $\theta = 1.8$

Session	1	2	3	4	5	6	7	8	9	10
	Moments about Mean									
1	0.28244070D-14	0.82406650D 00	-0.53244400D-01	0.12624000D 01	-0.75515100D 00	[illegible] 01	[illegible] 01	0.69504560D 01	-0.15613200D 02	0.33262640D 02
2	0.30753180D-14	0.35061230D 00	0.15257630D 00	0.37865420D 00	0.33053520D 00	0.55102000D 00	0.59712220D 00	0.66846760D 00	0.10244[illegible]0D 01	0.14069450D 01
3	0.25446310D-14	0.23222260D 00	0.92826360D-01	0.20967450D 00	0.18982940D 00	0.30537960D 00	0.35535710D 00	0.50561850D 00	0.63504240D 00	0.80367060D 00
4	0.19761970D-14	0.14672030D 00	0.43316370D-01	0.92374130D-01	0.62912180D-01	0.12100000D 00	0.14779950D 00	0.23127560D 00	0.26175100D 00	0.35042320D 00
5	0.23359090D-14	0.10273500D 00	0.25106340D-01	0.53517690D-01	0.43912740D-01	0.64537100D-01	0.75671150D-01	0.10316120D 00	0.13362510D 00	0.17762060D 00
6	0.16031620D-14	0.71179600D-01	-0.88122390D-03	0.13066620D-01	-0.11780430D-03	0.34045270D-02	0.24957350D-04	0.10364030D-02	0.32321590D-04	0.34157340D-03
7	0.22404330D-14	0.61588990D-01	0.33357950D-03	0.11708940D-01	0.26396720D-03	0.32660520D-02	0.13173730D-03	0.11067630D-02	0.61677320D-04	0.41066760D-03
8	0.18518520D-14	0.49278150D-01	0.27895160D-03	0.78309060D-02	0.71368120D-04	0.19437740D-02	-0.41590650D-04	0.38467600D-03	-0.42230680D-04	0.19235140D-03
9	0.21960210D-14	0.46652450D-01	0.64552330D-03	0.81666990D-02	0.16254720D-03	0.23204660D-02	0.16531960D-04	0.77354260D-03	-0.64376630D-05	0.27179620D-03
10	0.22515320D-14	0.41226060D-01	-0.27692310D-03	0.74649430D-02	-0.93309930D-04	0.22974330D-02	-0.22605020D-04	0.81165260D-03	-0.11362610D-04	0.22525960D-03
11	0.18096640D-14	0.33767130D-01	-0.10963880D-02	0.41137490D-02	-0.46346500D-03	0.77661160D-03	-0.15060750D-03	0.16019010D-03	-0.30244020D-04	0.46351660D-04
12	0.18962610D-14	0.30574770D-01	0.11623980D-03	0.30627920D-02	-0.23445780D-04	0.49952760D-03	-0.10733310D-04	0.77120630D-04	-0.31604060D-05	0.14304470D-04
13	0.14277470D-14	0.29961890D-01	0.34132800D-03	0.29670760D-02	0.39739620D-04	0.43946260D-03	0.29043950D-05	0.77689650D-04	-0.21756220D-06	0.15148330D-04
14	0.15765170D-14	0.28587430D-01	0.87796030D-03	0.25509510D-02	0.19198010D-03	0.32177120D-03	0.34372740D-04	0.46008440D-04	0.66366260D-05	0.73320190D-05
15	0.16675550D-14	0.28731090D-01	0.12961660D-02	0.24126290D-02	0.33050940D-03	0.31099270D-03	0.72329020D-04	0.49850860D-04	0.15317040D-04	0.89669040D-05
16	0.13700150D-14	0.26604660D-01	0.13367030D-02	0.21335240D-02	0.28968910D-03	0.26517120D-03	0.50175620D-04	0.35795660D-04	0.19601720D-04	0.66698510D-05
17	0.14677150D-14	0.25038370D-01	0.60819660D-03	0.17742710D-02	0.88042120D-04	0.17594220D-03	0.20525980D-04	0.20226010D-04	0.10754360D-05	0.25102620D-05
18	0.17763570D-14	0.23855860D-01	0.83952020D-03	0.16988090D-02	0.17916840D-03	0.17576950D-03	0.33579410D-04	0.21337030D-04	0.48713060D-05	0.28111200D-05
19	0.19939610D-14	0.24326170D-01	0.65222110D-03	0.17713990D-02	0.15185040D-03	0.14662750D-03	0.27616220D-04	0.23044040D-04	0.46742600D-05	0.31074590D-05
20	0.19295680D-14	0.22392010D-01	0.67079930D-03	0.15501800D-02	0.15324140D-03	0.15604550D-03	0.27221940D-04	0.14666560D-04	0.44664200D-05	0.24691110D-05

Table A-2-2 (Continued): Group 8, θ = 2.6

Session	Moments about Mean 1	2	3	4	5	6	7	8	9	10
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.31534110D 00	-0.37357220D 00	0.46910240D 00	-0.61641500D 00	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.50790190D-01	-0.43714170D-01	0.39993630D-01	-0.36974370D-01	0.34790140D-01
3	[illegible]	[illegible]	-0.16331560D-01	[illegible]	[illegible]	0.14564260D-01	-0.90115640D-02	0.77350520D-02	-0.99172340D-02	0.49777020D-02
4	[illegible]	[illegible]	-0.17216930D-02	[illegible]	[illegible]	0.83420100D-02	-0.31937300D-02	0.30167670D-02	-0.16397150D-02	0.12669770D-02
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.44546830D-02	-0.60716330D-03	0.10586640D-02	-0.26282680D-03	0.28362750D-03
6	[illegible]	[illegible]	0.10220550D-01	[illegible]	[illegible]	0.34734690D-02	0.21270840D-03	0.74872840D-03	-0.20725590D-04	0.17953670D-03
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.24863140D-02	0.57285740D-03	0.47987570D-03	[illegible]	0.95410630D-04
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.25134240D-02	0.48714630D-03	0.52358470D-03	0.80194900D-04	0.11516780D-03
9	[illegible]	[illegible]	0.13925170D-01	[illegible]	[illegible]	0.22586310D-02	0.62512250D-03	0.46665220D-03	0.12917510D-03	0.95470350D-04
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.18765560D-02	0.69505130D-03	0.40028320D-03	0.16034120D-03	0.87373310D-04
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.17214410D-02	0.58014480D-03	0.36278360D-03	0.13093180D-03	0.78506560D-04
12	[illegible]	[illegible]	[illegible]	[illegible]	0.22644620D-02	0.16205540D-02	0.54166670D-03	0.35725050D-03	0.12329510D-03	0.83420860D-04
13	[illegible]	[illegible]	0.73666020D-02	[illegible]	0.21629210D-02	0.13984440D-02	0.54322660D-03	0.31281210D-03	0.12947160D-03	0.71377290D-04
14	[illegible]	[illegible]	[illegible]	[illegible]	0.23227200D-02	0.13985510D-02	0.60366810D-03	0.32687250D-03	0.15058640D-03	0.78178820D-04
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.10881580D-02	0.49979570D-03	0.26831440D-03	0.13115590D-03	0.65067300D-04
16	[illegible]	[illegible]	0.58316940D-02	[illegible]	[illegible]	0.10246170D-02	0.47766640D-03	0.24996170D-03	0.12272950D-03	0.62609400D-04
17	[illegible]	[illegible]	[illegible]	[illegible]	0.13621770D-02	0.76202090D-03	0.36853490D-03	0.19319510D-03	0.97666480D-04	0.50393270D-04
18	[illegible]	[illegible]	0.17130460D-02	[illegible]	[illegible]	0.24629930D-03	0.11524560D-03	0.61499370D-04	0.31702570D-04	0.16760340D-04
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.24880480D-03	0.11855700D-03	0.63127880D-04	0.32731570D-04	0.17337930D-04
20	[illegible]	[illegible]	0.51092170D-03	[illegible]	[illegible]	0.24092920D-04	0.28942270D-05	0.12856190D-05	0.18851670D-06	0.72146160D-07

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